"AUTOMOBILES IN TELEPHONE WORK" IN THIS NUMBER

TELEPHONE ENGINEER

Vol. VI CHICAGO, SEPTEMBER, 1911 No. 3

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Trade Mark
"Weld-Clad"

Are you getting your dollar's worth?

What is your dollar's worth?

Is there *any* difference between cost, value and price?

There are suggestions on this subject on advertising pages four and five.

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NEW YORK

Monadnock Block
CHICAGO

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Unimpaired By Thirty-Two Years' Service

The Kerite Twelve Conductor Cable, a section of which is illustrated above, was placed in service in 1879 and it is giving perfect service today, 1911.

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KERITE INSULATED WIRE AND CABLE COMPANY

Incorporated by W. R. Brixey

General Offices

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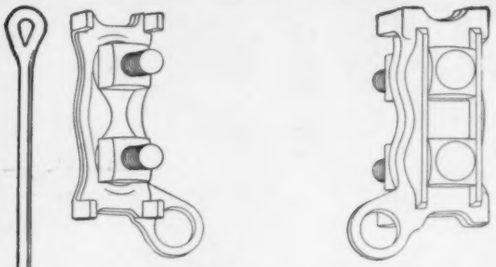
Western Office

Peoples Gas Building, Chicago

80-2057



Matthews 2-Bolt Guy Clamp

¶ Combines all the advantages of the standard 3-bolt clamp and of the Crosby Clip.

¶ Will hold twice as much strain as the 3-bolt clamp.

¶ Can be put on in less than four minutes.

¶ Will be shipped on 30-days' trial. Freight will be prepaid on your first order of 100 or more. They may be returned, charges collect, if they don't more than save their cost to you.

W. N. MATTHEWS & BROTHER

Manufacturers of these patented money-saving specialties

Matthews Poleractor, Matthews Guy Anchors, Matthews Cable Rollers, Matthews Cable Hangers, Matthews Cable Splicing Joints, Matthews Bridle Rings, Matthews Telefault

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A tool in the pocket is worth ten in the chest.

KLEIN'S Electrician's Pocket Kit

is a durable, compact, genuine leather case containing 5″ side cutting pliers, 6″ long nose side cutting pliers, 5″ oblique pliers, all KLEIN make; also screw driver, electrician's knife and nickel-plated snips. Can be depended upon for reliable service.

Write for catalog 7E covering Linemen's tools.

Mathias Klein & Sons

Station U 20 CHICAGO, ILL.

Telephone Engineer

WITH WHICH IS CONSOLIDATED THE WESTERN TELEPHONE JOURNAL
ESTABLISHED 1902

VOL. VI | CHICAGO, SEPTEMBER, 1911 | No. 3

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ED J. MOCK and PAUL H. WOODRUFF, Editors.

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LONG DISTANCE TELEPHONE: HARRISON 8014.

NEW YORK OFFICE .....1433 Hartford Building, 41 Union Square
Telephone Stuyvesant 1672.
LONDON OFFICE.....36 Maiden Lane, Covent Garden
S. RENTELL & Co., Representatives.

Entered as second-class matter May 26, 1909, at the postoffice at Chicago, Illinois, under Act of March 3, 1879.

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Canada .....Per year, 2.50
Foreign countries within the Postal Union.....Per year, 3.00
Single Copy 20

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Changes of advertising copy should reach the office of publication not less than ten days in advance of date of issue. Regular date of issue, the first day of each month. New advertisements will be accepted up to within five days of date of issue, but proof of such advertisements can not be shown in advance of publication.

NOTICE TO SUBSCRIBERS.

REMITTANCES.—Remittances should be made by check, New York draft or money order, in favor of TELEPHONE ENGINEER. Foreign subscriptions may be remitted direct by International Postal Money Order, or sent to our London office.

CHANGE OF ADDRESS.—The old address should be given as well as the new, and notice should be received two weeks in advance of the desired change.

CLUB RATE.—In acknowledgment of assistance rendered by subscribers in the securing of new orders, a club rate of $1.50 per annum is quoted. This rate applies to new subscriptions in clubs of two or more.

This publication is free and independent of all business or house connections or control. No telephone company, manufacturer or supply dealer, or their stockholders or representatives have any financial interest in TELEPHONE ENGINEER *or any voice in its management or policy.*

CHICAGO, SEPTEMBER, 1911.

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AUTOMOBILES FOR TELEPHONE EXCHANGES.

EVERY telephone system covering more than a few miles of territory uses some kind of a vehicle for transporting men and materials. Whether the vehicle is owned by the company or hired for the occasion, its use constitutes a necessary expense. And since this expense is unavoidable, it follows that the vehicle that shows the smallest expense account, whatever its motive power, is the most economical for the telephone company to use.

There is a general idea that the automobile, whether of the business or pleasure type, is essentially a luxury. Many people, when they see the local grocer, for example, using a new automobile delivery wagon, can conceive of only three possible motives for his expenditure—vanity, desire for publicity, or sheer foolishness. It does not occur to them that the first cost of the car may be little greater than that of a good horse and wagon, and that the saving due to greater rapidity and lack of expense while idle probably results in an actual increased profit for the grocer.

The preponderance of pleasure vehicles in the motor-driven class is, of course, responsible for the popular view of the small commercial automobile. That it is a short-sighted or ignorant view is proven by the facts. There is no question but that the telephone system that uses any vehicle with some regularity will gain by the use of a motor car.

The gain in operating expense, of course, lies in quicker travel and consequently more work done in a given time, hence lower labor costs per job; and in the absence of running expense while the car is idle. But that is not the only advantage of the motor driven over the horse drawn vehicle for telephone work.

In the early days of public utilities the public had to bow to the corporation. Today the corporation not only bows to the public, but if its service is not satisfactory it hears from its customers promptly and decisively. Competition on the one hand, and regulation on the other, have brought about a demand for the highest possible efficiency as a qualification for success in public service.

A moment's thought will convince any telephone man that the automobile trouble wagon, the automobile inspection car, the automobile supply truck, will do as much as any one improvement can do for the betterment of service and the satisfaction of the public.

The public knows little and cares less about the complications of telephone operation. When there is trouble, explanations do not fill the bill. The thing to do is to get the instruments back into service; not "as soon as we can," but right away! And the same is true of new installations. When a new contract is

obtained the subscriber wants his telephone. Anything that will get it to him quicker adds to his satisfaction and contributes to good will.

Then there is the publicity feature—the only one of the popular hypotheses, as related in connection with the grocery wagon, that is correct. There is no question but that the sight of an automobile hustling along the road with the operating company's name on its side, does much to create public confidence in the sincerity of the company's efforts. There is a tendency, too, to believe that the company so up-to-date as to use automobiles in its daily business must be strictly modern and efficient in its other appointments. Even the man who criticises the small grocer for his apparent vanity in buying a motor delivery car will view the public service corporation's use of a similar "luxury" in a different light.

The big telephone company already uses automobiles wherever it can find a use for them. It only remains to convince the small companies that the motor vehicle is an economy instead of a luxury, and they will have better service, better maintenance, and a lower expense.

MORE MUNICIPAL RATE JUGGLING.

ONCE more we are confronted with the spectacle of a city council deliberately ignoring the report of an expert it had hired to investigate the rates of its public utilities, because the figures of the expert did not agree with the desires of the council. The performance, which had already been given in Wichita, Kan., and Chicago, Ill., appears this time in Los Angeles, Cal.

Los Angeles has, or rather had, a board of public utilities. Early in 1910 this board, desirous of fixing telephone rates that should be equitable to both the operating companies and the public, engaged expert W. F. Sloan, of the Wisconsin commission, to appraise the two telephone plants.

The Pacific Telephone and Telegraph Company and the Home Telephone Company were duly investigated and Mr. Sloan's report filed with the board of public utilities. The expert's figures suggested several changes in existing rates, making the rates the same for both companies. So much having been done, the city council promptly passed an ordinance providing new rates which absolutely ignored the recommendations of the Sloan report, and actually reduced the incomes of the companies. The Bell company obtained a temporary injunction against the enforcement of the new ordinance, while the independent company accepted the new schedule.

Thus brought to court to prove its case, the city council brought Kempster B. Miller from Chicago, for the purpose of refuting the Sloan report. Mr. Miller was thoroughly familiar with Los Angeles conditions, and his reputation as a telephone expert is international. His appraisal and report, entirely independent of the previous Sloan report, so closely paralleled the latter that there was little left that was new for the city council to do.

Thereupon the Board of Public Utilities once more issued a schedule of rates similar to those which depended upon the Sloan report. At once a protest arose. The telephone using public had seen a promise of lower rates in the enthusiastic but misguided efforts of the city council. So the council appointed a committee to fix the rates once more.

To this committee the Board of Public Utilities brought evidence in the shape of rate schedules from sixty other cities, of which ten were telephonically in the same class with Los Angeles. In practically all of them the rates averaged higher than those under discussion.

This closed the argument for higher and more equitable rates. The committee, it is presumed, considered the evidence; but no indications that it did so appeared in the ordinance drafted by the council. The rates in the new ordinance are identical with the existing rates.

Observe the remarkable tenacity of purpose of this honorable body, the city council of Los Angeles. Determined to have telephone rates to suit its own ideas, it has hired experts to give unbiased reports, and has discarded those reports because they were unbiased. Enjoined from enforcing its first ordinance embodying rates founded on guesswork, it has passed a second ordinance just like the first. The only appeal of the operating companies is to the courts.

What is the psychology of the common city council? Why do they, seemingly as a class, persist in hiring experts and ignoring their reports? What is the mentality of the average politician, that he considers himself more competent to decide all questions than the experts and the courts?

This condition of municipal rate juggling, as exemplified at Wichita, Chicago, Los Angeles, and other cities is, of course, temporal. When state commissions on public utilities are universal, as they must become, we shall be freed of the rate-juggling city council.

COMMERCIALISM.

OUT of twenty-five thousand operating telephone systems in this country seventeen thousand are farmers' lines, purely co-operative and yielding no direct profit to any investors. Of the remaining six thousand systems, which have actual exchanges, some five hundred are so-called "mutual" companies, organized on a profit-sharing or non-commercial basis. These are, of course, all "round" numbers.

The mutual telephone system is the farmers' and small business man's side line. While it is small he can control it with little investment of money or time. When it grows he must either let it pass out of his hands or give it a substantial share of his time or money.

So the shareholder in a mutual system, or the member on a farmers' line, is not particularly anxious to have the system grow too large for convenient handling. He is satisfied with the present close co-operative arrangement and a terminal on the town switchboard. If Jones wants a telephone, let him organize his own line and get another jack in the board.

So the farmers' line, exemplification of American enterprise and progress as it is, still stands almost in the way of that ultimate development which approaches the saturation point of the country's population.

The gregarious instinct, the desire for human companionship and communication, is a great incentive to telephone construction. But if the construction is done with a view to making a legitimate business profit out of the service rendered, the incentive is greater. The co-operative farmers' line has civilized our back woods; but only the efficient commercial

organization, working for a profit, can give us telephonic saturation.

The operating companies have learned, only within the last few years, that farmers' lines terminating on their switchboards are profitable and good business. If they are profitable as independent tributaries, they would be profitable as integral parts of the system.

When every farmers' line has become part of a larger system, owned and operated as such, and when every mutual system is made commercial, there will be a more determined effort to gain subscribers and a more rapid telephonic growth than there is just now. We sometimes decry commercialism; but the trouble with the telephone business is that there is not commercialism enough in the broad stretches of the country.

THE MAXIMUM OF DISTRIBUTION.

LAST month TELEPHONE ENGINEERING published in its editorial pages an analysis of the operating field, showing that practically all of the business is in the hands of some six thousand companies, the remainder of the twenty-five thousand "systems" of the country being farmers' lines of little commercial importance.

TELEPHONE ENGINEERING has never laid claim to extensive circulation among these farmers' lines, for the reason that it has never actively solicited their subscriptions. We have been content that in going to the six thousand commercially important we are covering over ninety per cent of the physical field, and about ninety-nine per cent of the financial field. Not that we intend by any means to discourage the farmers' lines; for we have some subscribers and good friends among them. But we are saying more about that side of the question in another editorial.

It is easy to claim circulation. To tell the truth, there is more bunk in some circulation statements than even a politician would dream of. That is why TELEPHONE ENGINEER has never been very noisy about its circulation; for noise means nothing. When we say we cover ninety-nine per cent of the telephone purchasing field we merely fall back on the proofs in our office.

Trade paper advertisers demand circulation statements, but they do not always call at the publishers' offices for proof. That is, most of them do not. But it is different with Frank W. Chambers, Jr., vice president of the Duplex Metals Company.

The Duplex Metals Company is marketing copper-clad wire. It is a big proposition, and must be handled in a big way. And the best way to accomplish that is to take big space in the trade paper reaching the largest buying proportion of the field.

Mr. Chambers was ready to advertise in a big way to the telephone field. He was already taking large space, as most advertisements go; but he wanted to convey some idea of the bigness of his proposition—to call forcibly to the attention of every telephone man the merits of his product. And he wanted to be sure, once he had taken space, that no telephone man who could read could possibly miss his advertisements.

He already knew in an ordinary way the merits and "pulling powers" of the telephone papers, for he had tried them. But in this bigger campaign he must have more positive information about their circulation—he must *be sure*. He investigated. He came to the office of TELEPHONE ENGINEER, and examined into details of circulation. And he was satisfied that we cover the field, and cover it in the right way—in a big way.

So Duplex Metal Company has become TELEPHONE ENGINEER's largest advertiser, taking our front cover and two inside pages. We take it as a compliment to the quality of TELEPHONE ENGINEER that it has been able, in a little more than two years, to attain the distribution that so interested Mr. Chambers. We are proud of our circulation and of our class of subscribers, and we wish every advertiser would come to this office, as Mr. Chambers did, and see for himself just what becomes of all the copies of TELEPHONE ENGINEER we print.

CONDUCTORS OF NO RESISTANCE.

A DUTCH scientist, Prof. H. Kamerlingh Onnes, has announced an experimental confirmation of the theory that at absolute zero (—273 centigrade) certain electrical conductors attain infinite conductivity—or, in other words, lose their resistance to the flow of electric current.

This discovery, if borne out by further experiments, opens a wide field of entirely new investigation. Speculatively, it would seem to render imperative the familiar Ohm's law by canceling one of its factors. Through a conductor of no resistance, an infinitesimal difference of potential would send a current of infinite amperage. Every circuit would be a short circuit.

Of course, it is unnecessary to point out that absolute zero is as unattainable in practice as is one-hundred per cent efficiency. But it is a fact that temperatures within a few degrees of absolute zero have been attained in the laboratory, and may even be adapted to practical application if there should be any incentive for so doing.

Telephone engineering is more concerned with inductances and capacities than with ohmic resistances. But there are possibly one or two parts of the telephone circuit where a considerable diminution of resistance would be of interest. Experiments in transmitter design, for example, might yield some interesting results. It is quite conceivable that the ordinary granular carbon transmitter, subjected to those exceedingly low temperatures, would lose the resistance of its carbon while retaining the resistance of the infinitesimal air gaps between the granules. The results might be an enormously increased variation in the voice currents produced by the transmitter, with a corresponding increase in talking efficiency.

The large number of inventors now working on the problem of producing a successful high-power transmitter seems to indicate that the next step in telephone development will come by way of transmitter improvement.

In this connection it may be well to correct a popular misapprehension. It is sometimes deemed impossible to make a transmitter that will produce a talking current capable of reproduction louder than the originating voice. This is a mistake. The modern transmitter does not convert voice vibrations into current, as did the old magneto transmitter; it merely produces fluctuations in an independent applied current. Given a powerful applied current and a transmitter mechanism capable of varying it to a maximum degree, and the voice may be magnified to any degree. In short, it is up to the transmitter.

Prof. Onnes' low temperatures may not solve the

transmitter problem, and indeed, may not affect telephonic science at all, even if ultimately reduced to practical values. But the possible consequences of a loss of resistance are so great in any branch of electrical manifestation that speculation is unavoidable.

TELEPHONES IN NIGERIA.

Consul W. J. Yerby, Sierra Leone, Nigeria, states that during 1909 an additional 180 miles of telegraph wires were brought into use, making a total of 1,409 miles, of which 918 miles are railway and 491 miles Nigerian government lines. The reconstruction by the government of the telegraph line on the Iddo-Ibadan section has entered on its third year, and is still in progress. Telegraph circuits are now working to Jebba, the number of instruments in use being 61. Electric staff working has been installed as far as Lanwa, 275 miles, making a total of 72 instruments. The number of failures during the year was 53, an average of 0.73 per instrument per annum. A considerable number of failures were due to the reconstruction of the telegraph line.

Phonopore communication between the traffic office at headquarters and Aro station (60 miles) has been satisfactorily established on a working telegraph wire. It is proposed to extend this line to Ibadan. The railway telegraph superintendent reports that 19 learners have been sent out from the school as improvers. Some of these boys do well, while others fail to make satisfactory progress. The reorganization of the telegraph school is now being considered by the traffic superintendent. The question of rates has received the close attention of the management during the year, and it was found necessary to make numerous reductions with the view of encouraging traffic and satisfying trade conditions generally.

JOBBING TRADE SAVES BY TELEPHONES.

Probably no branch of trade has done more to develop the telephone than the wholesale and jobbing end. This is partly due to small retail stores, which, carrying a limited stock of goods, are compelled to order at any and all times. To them it has meant a great amount of time and carfare saved, to be able to call the firm which handles their goods and get an early delivery.

But, to a great extent, neither jobber nor wholesaler has tried to develop this telephone trade. Perhaps they have not realized that their city salesmen could get over a great deal more ground at one-fifth the expense if they "called on" this local trade by telephone. That it is a good method is proved by the way in which the retailer has taken to the telephone order idea. He likes this method, and he is using it to its full extent. This should open the eyes of the wholesale man to its possibilities. Telephone selling will mean a large saving in expense.

All the surrounding towns may be reached in the same way. Toll calls are much less expensive than a trip, while the time-saving is enormous—time which may be realized upon by putting it to use in getting new trade in an enlarged field.

Out-of-town customers are particularly pleased with such a method, especially if an effort is made to conform the deliveries to the speed of the telephone order. Many of these retailers will themselves telephone to town when an article is needed in a hurry. The progressive dealer knows that every effort must be made to quickly fill the customers' demands, and the telephone is his emergency messenger. But if the wholesaler fails to respond by arranging for a quick delivery, the telephone order is practically useless.

A study of this telephone selling method by wholesalers and jobbers would develop many profitable schemes. Most manufacturers and wholesalers have catalogues and price lists which are sent broadcast to the field. From time to time new articles are added and old ones are changed in detail, while prices are almost constantly fluctuating. Would it not be a most admirable plan to keep the dealers constantly informed of such changes by telephone? Such a plan would produce instant results in the way of more sales of the new articles and of the old ones at new prices. Then, too, these small odd lots of merchandise which wholesalers and jobbers are constantly able to obtain at advantageous prices can also be quickly disposed of to the dealer by means of a quick telephone canvass of the territory.

The important question of how to move stocks and move them quickly, a constant source of worry to many merchants, is answered in just three words; Use the telephone.

Houses guided by a wise policy will undoubtedly use the telephone more and more to facilitiate ordering by the retailers. It is the quick, time-saving and economical method.

TELEPHONE FUTURES IN MILWAUKEE.

Milwaukee in 1930, with 600,000 inhabitants, was pictured by President Alonzo Burt of the Wisconsin Telephone Company at a smoker of the Merchants and Manufacturers' Association of Milwaukee, Wis.

Mr. Burt's forecast was made upon investigations made by the telephone company, which took a practical census of the city with the intention of discovering how greatly its plans must be increased in order to provide for the service in twenty years.

"Under the public utility law," said Mr. Burt, "a telephone company is required to furnish service for all applicants within reasonable time after the application is received. It would be impracticable to wait until we received the order and then string our wires. Our plants and equipment must be ready ahead so that we can supply the subscribers without delay.

"Upon this investigation we rely to tell us where our growth is to occur, and we shall increase our equipment to be ready to take care of the new customers. We do not expect to go ahead immediately to build for the number of telephones that will be needed in twenty years. But in the coming few years we expect to invest several million dollars on this study which we have made.

"The basis of such a study is the number of people who will live in the territory which we serve. Unless something entirely out of the ordinary occurs to retard the progress of the city, we believe that the population will grow as fast in the future as in the past. We found that this had been some 53 per cent, which would give Milwaukee in 1930 a population of 600,000.

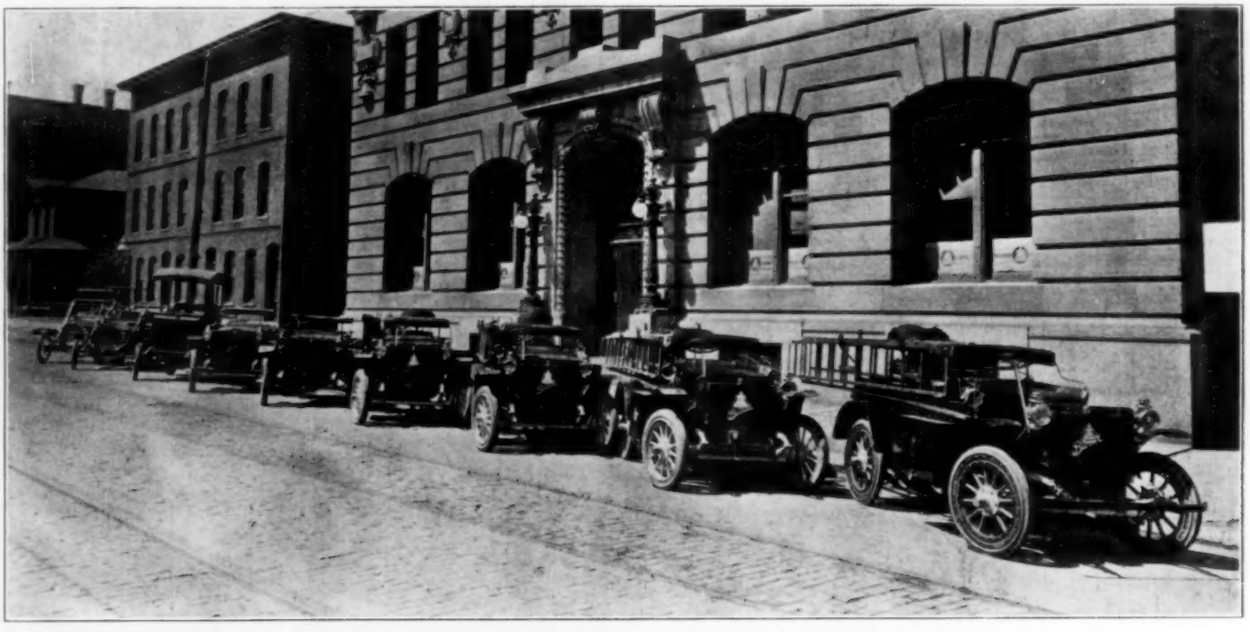
"Our men have made a house to house study of the city to determine how the city would grow, so that we might determine what kind of service would be needed in different localities. Hotels, business houses, office buildings, residences and even vacant lots were computed with reference to their coming telephone requirements."

Automobiles in Telephone Work

Meeting Modern Exchange Requirements

AUTOMOBILES are not by any means innovations in telephone work. Since the constantly increasing volume of business and constantly expanding territory covered by operating telephone companies necessitated the use of some sort of vehicle, it was but natural that the undoubted economy of the motor driven wagon or carriage would be brought to the attention of the telephone operator, and today we find that there are a surprising number of automobiles in use by operating companies. They range from the motorcycles and the light runabouts used for trouble hunting and inspection work to the heaviest commercial trucks manufactured.

Some time ago TELEPHONE ENGINEER wrote to the larger independent and Bell operating telephone companies all over the country, asking for information as to their use of the automobile in their daily routine.



Automobiles Used by the Wisconsin Telephone Company.

The replies seemed to indicate that there is no particular relation between the size of the company and the number of automobiles used. Some of the largest companies are just beginning to give the modern vehicle a trial. Some of the smaller companies have a number of automobiles of various sizes and uses. But as a rule the larger companies have been using a number of cars for some time and are prepared to give definite data as to the saving effected by their use. Some companies, not entirely satisfied with the commercial types of cars, have even gone so far as to have the bodies of standard types changed to suit their peculiar requirements. A noteworthy example of this procedure is the unique auto truck used for distributing station equipment in Buffalo, N. Y. The special design and arrangement of the body of this car, which is a 60 h. p. four-cylinder Thomas, were worked out by L. E. Carson, district plant superintendent for the New York Telephone Company. The *Telephone Review*, a publication issued by the New York Telephone Company, recently contained an interesting description of this peculiar car.

On the floor of the car at the sides and running the entire length are two rows of small trays. Each tray is divided into two compartments and holds four bell boxes. The body of the car extends seven inches over the wheels, forming shelves on which are carried desk stands. Above the desk stand are trays extending the entire length of the car, on which are carried small wall sets and standard back boards. The arrangement provides for carrying 44 bell boxes, 28 desk stands, and 14 back boards or wall sets. There is also floor space seven feet long and two and a half feet wide which can be used for carrying telephone directories, wire and other material.

The car is provided with curtains, on both sides and the rear, and has a wind shield in front which extends to the top of the cover. Mounted on a spring roller and attached to the upper portion of the wind shield is a map of the city of Buffalo.

Upon receipt of notice of the completion of drop wire work the chief foreman of installers checks up a disbursement ticket covering the equipment and material for the contract orders on hand. The contract order for each job is placed in a small leather case which is sent to the store keeper and it depends on him for the equipment specified. The contract order also serves as a delivery ticket.

The reports of the completed work are enclosed

in a case and returned to the office to the installer foreman. When reporting to the latter by telephone upon the completion of an order, workmen ask for information regarding the next job and at the same time get sufficient material for the future. They carry with them two days' supply of wire, knobs, screws, etc. When material is running short the workmen report by telephone and await delivery by the truck. By means of these arrangements installing forces have no occasion to call at the store room. While this idea

Auto Truck Used by the Wisconsin Telephone Company.

has been in use a comparatively short time and its efficiency has not yet been reduced to figures, the plant department is saving at least 54 hours of labor per day and about $10 carfare per week. The price for keeping the trucks in service is $30 per week. The three small illustrations show the truck, its interior and the arrangement of the instruments it carries.

Automobiles do not seem to be as popular with companies operating in mountainous regions as in the more level portions of the country. Kansas City, for example, has a reputation for sloping streets and the Kansas City Home Telephone Company reported that it has not yet taken up the use of automobiles to any great extent, merely using a small runabout in which the superintendent of construction makes trips over the property. The company has, however, adopted motorcycles for the use of its trouble men and finds them exceedingly satisfactory as far as saving time in directing trouble is concerned.

The New England Telephone and Telegraph Company begun to use automobiles six or seven years ago. They have proven not only an economy, but have exemplified their usefulness in emergency a great many times when construction men have been compelled to travel some distance in a hurry to repair a line. In the company's Boston, Western and Central divisions they are largely used. The Eastern division, which includes the state of Maine, is afflicted with very bad roads and for that reason only motorcycles are used in that state.

The company uses in its Boston division 38 automobiles and 18 motorcycles. Of the motorcycles there are ten Indians of 5 h. p. each, seven Indians of 3½ h. p. each and one Indian of 4 h. p.

Of the runabouts, of which there are eight, four are Middlebys, 25 h. p. each; one 18 h. p. Buick; one 10 h. p. Autocar; one 10 h. p. and one 8 h. p. Cadillac.

There are seven touring cars, of which one is a Pierce Arrow of 45 h. p., one Stoddard Dayton of 40 h. p., one Mitchell of 35 h. p., one Columbia of 32 h. p., 2 Cadillac of 30 h. p. each, and one Cadillac of 12 h. p. Of auto trucks the company uses 23, whose characteristics tabulate as follows: One 5-ton Sampson of 40 h. p., one 4-ton Sampson of 40 h. p., one 3-ton Knox of 16 h. p., four 1½-ton Rapids of 25 h. p., one 1-ton Rapid of 24 h. p., two ¾-ton Sampsons of 22 h. p., four ¾-ton Chase of 20 h. p., one ½-ton Knox of 12 h. p., and four ½-ton Holsoms of 12 h. p. each. These are all used in the company's Boston division.

In its Central division the New England Company uses eight Indian motorcycles, five of which are of the 2-cylinder 5 h. p. type. The other three are single-cylinder machines, one of 4, one of 2¾ and one of 2½ h. p. Four runabouts are used, two Mitchell of 20 h. p. each, a Buick of 18 h. p. and a Chalmers-Detroit of 25 h. p. Two 32 h. p. Buick touring cars are also used. The Central division also has three trucks—a Rapid 1½-ton 30-h. p., a Chase ½-ton 20 h. p., and a Buick model 2A 22 h. p.

The company's western division is strong on motorcycles. It has 15 of the two-cylinder magneto 5 h. p. machines, two 7 h. p. two-cylinder magneto machines, four 3½ h. p. magneto and eight 3½ h. p. battery single cylinder machines, and two 2¾ h. p. single cylinder battery machines. These are all of the Indian brand. The western division also uses one 6-cylinder Pierce Arrow of 30 h. p., two 4-cylinder Knox of 40 h. p., one 4-cylinder Cadillac of 30 h. p. and one single cylinder Cadillac of 10 h. p.

The Wisconsin Telephone Company has had quite an interesting experience with automobiles in telephone work. In October, 1909, the company pur-

Part of the New England T. & T. Company's Boston Garage.

chased a model KK McIntyre high-wheel type automobile runabout for the use of the Milwaukee district foreman. This man has the general superintendence of all outside plant work done in the Milwaukee district in the territory of 1,223 square miles. A great deal of his time is taken up in laying out and inspecting new work, inspecting the outside plant work generally and overseeing changes which may be necessary, and is the general superintendent of the crews that work in his district.

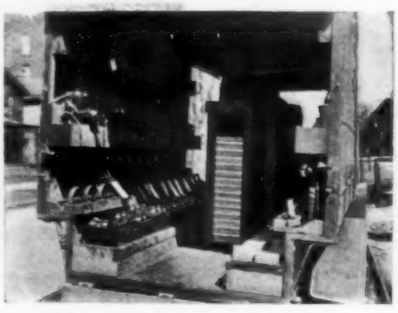
Some of the Runabouts Used by the Cumberland Telephone and Telegraph Company.

They decided to get a heavier car and in August, 1910, a model 10 Buick runabout was substituted. This car has been in continual service since then and has enabled a better supervision of the work and effected a saving of one quarter of the district foreman's time. After three months' trial of the Buick runabout the company purchased a similar car for the Milwaukee district cable foreman. This man has under his supervision the cable splicers and their helpers, who do all of the cable splicing construction and maintenance work in the Milwaukee district. The use of this runabout has enabled much better supervision of the work and permits the foreman to be on the job quickly in case of trouble. The company has found it a big step forward in obtaining continuity of service, which, of course, every company is working for. Both the district foreman and the district cable man used a horse-drawn vehicle previous to the purchase of the runabouts.

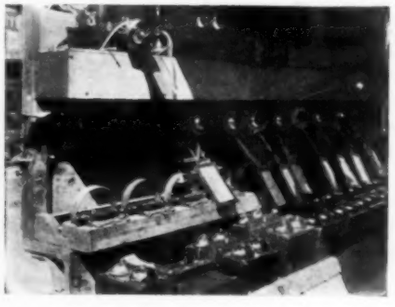
The company also uses an automobile one-ton truck to transport tools and supplies from the Milwaukee depots and the company's warehouse to the various Milwaukee offices. It has also in use a model 2A 1000-pound capacity Buick truck to transport the cable splicers, helpers and tools and the light construction material from one job to another among the Milwaukee exchanges which cover an area of 167 square miles. These men are under the supervision of the cable foreman who drives the Buick runabout. The truck has been in service for a year and is doing very efficient work. It is saving the service of an additional cable splicer and helper and it is rendering the work in its department more rapid and efficient. The fact that the company has always been able to be on the job quickly after trouble is reported sometimes has effected a considerable saving, especially on underground cable trouble due to water, in which case if there is any considerable delay the water may get back in the splice and make the repair very expensive. The above mentioned cars are all standard and not remodeled in any way to meet a special purpose.

Later the company purchased five of the model 2A Buick 1,000-pound capacity trucks, similar to the truck used for cable work, to be remodeled as line order wagons. It now has three of these cars in service and the other two in the course of preparation. The cars are so equipped that there is a place for everything with the idea that things will be kept where they belong and not scattered about the car. These trucks carry a complete outfit of the tools used in this class of work as well as all the construction material which will be used by the crew. The cars are used as line order wagons to carry the crew to run the wire from the cable terminals to subscribers' places of business

The Auto Truck Used in Buffalo.

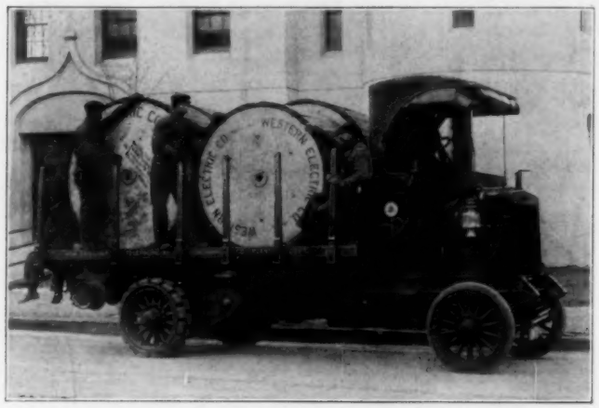


Interior of the Buffalo Truck.



How Instruments Are Held in Place.

or residences. One of the photographs reproduced here shows a view of one of these trucks. The company reports that these line order trucks effect a considerable saving of time, which of course means quicker installation and therefore better service to subscribers. So far in the use of automobiles the experience has been generally satisfactory and the cars have proven in for the place for which they were purposed. The use of automobiles on jobs where the company placed them has greatly facilitated construction and



New Five-Ton Truck Used by the New England Telephone and Telegraph Company.

maintenance work, and while this is of more or less intangible value it really means considerable to the operating company and has also some advertising value, indicating to the public and to the company's subscribers that the company is using up-to-date methods to give them good service. Grocers and other small merchants who have used automobile delivery wagons found this to be true, and it surely is true also in the case of the public service corporation.

The Southern Bell Telephone and Telegraph Company, with headquarters at Atlanta, Ga., is using but one automobile trouble wagon. The company, however, has several other automobiles which are used by men of supervisory capacities to overlook the work, and reports that while it has no definite figures to show the actual saving by these cars, the management is convinced that a considerable saving has been made, both in a closer supervision of the work and in the time that a man spends in such supervisory capacity, allowing him to do more work. The company has just finished a garage in Atlanta to take care of the cars used in that city. While such use is still more or less experimental the company reports very satisfactory service from its automobiles and finds the trouble wagon especially useful. A considerable saving has resulted from its use, both in the efficiency with which trouble has been cleared and the smaller expense involved in clearing trouble. We publish herewith a form showing how the Southern Bell Company keeps track of its automobile expenses and give a typical account for the trouble car used by the company for the period of ten months. Besides the data furnished in this table the form itself is of interest as embracing in compact form all the necessary items for an account of this kind.

The Cincinnati and Suburban Bell Telephone Company, Ohio, uses altogether five cars, for which it has a very fine garage. Three Marmon runabouts are used by the superintendents of the different departments. Then there is a large three-ton Packard truck and a No. 15 United States motor wagon. The runabouts enable the superintendents to get over their territory speedily, which is of great benefit to the company. The Packard truck does the work of about three teams and the United States motor wagon is used for delivering equipment to new subscribers and collecting instruments that are discontinued.

The Cumberland Telephone and Telegraph Company at Nashville, Tenn., uses automobiles in construction work and keeping up trouble, using ten one-seated machines and one large Gramm truck. Four of the cars are used exclusively on trouble—three for local and one for toll line. These trouble cars work from the last cable box on the pikes, and there are about thirty good pikes in Davidson county, thirteen of them leading out of Nashville, and the others cross connecting. One machine is fitted up with body for a cable car and is used by cable foreman in placing his men and material about the city; two are used by the foreman of construction and his assistant, and one held in reserve. One is used by the shops and supply department about the city, the other by the pay station collector visiting the pay stations on the numerous pikes. The Gramm truck is used by the line order crew, and catches all the long runs out the pikes as well as around the city. The company figures that two trouble men with automobiles will take the place of three men with horses and vehicles. Its garage is one of the best equipped in the city, having machinery of all kinds for making repairs. It also has a vulcanizing department, and employs some of the best mechanics in Nashville.

The Bell Telephone Company of Pennsylvania, about a year and a half ago, purchased four 30 h. p.

Corner of the Cumberland T. & T. Garage.

Mitchell runabouts which are used by the company's plant superintendent of the Baltimore and New Jersey division, the machines being used for supervisory purposes. As a quick means of clearing trouble the company has been using the Indian motorcycle and has furnished motorcycles to its trouble men in place of using its own or hired teams. This has resulted in a large economy in the time required to clear trouble and the number of people needed, and a consequent large reduction of feed hire bills.

Pittsburg, Pa., is in the same class with Kansas City, in that it has a very rough topography. For this reason the Central District Printing and Telegraph Company has never thought it economical to use automobiles for any general work purposes. The company, however, uses two touring cars of ordinary style for supervision purposes and finds them extremely useful. The Pacific Telephone and Telegraph Company, San Francisco, Cal., is another one whose use of automobiles is entirely experimental so far and the company consequently is not ready to report on the economy effected by their use.

The New York Telephone Company states that it has ordered several Mack trucks and Ford roadsters, but is not yet in a position to make any definite report on their advantages. In this connection it is interesting to know that the Bell telephone companies recently purchased a total of 2,500 automobiles for use for inspection purposes. These cars will be divided among the operating companies throughout the country. The size of this one order indicates the appreciative light in which the large operating companies view the automobile as a labor saver.

The Chicago Telephone Company is quite a large user of automobiles. It has in use at present 21 Holsman runabouts, 7 Brush runabouts, two 4-cylinder 5-passenger touring cars, two 6-cylinder touring cars. The latter are run about 2,000 miles per month. The company originally had five light motor trucks, but is only operating three of these.

The telephone department of the Illinois Tunnel Company, which operates the independent automatic system in the city of Chicago is using at present one Pullman touring car and one Mitchell runabout. The company finds these cars not only useful, but almost indispensable to its business and will probably invest in more as its business grows.

These illustrations of the automobiles in use by operating companies could be continued indefinitely,

Trouble Runabout on the Cumberland Lines.

since there is hardly a company of any size that has not had experience with at least one car used in its daily work. The purpose of this article has been not

SO. BELL TEL. & TEL. CO.
AUTOMOBILE EXPENSE STATEMENT, 1910-11
ATLANTA EXCHANGE

Car Number 7. *Location,* ATLANTA EXCHANGE.

Make of Car, MAXWELL. *Type AA.* *Cost,* $645.00. *Used by* H. G. HALE. *In Service,* MAY 25, 1910.

	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Chauffeurs' wages	....	....	....	....	....	....	....	....	....	....
Garage	....	....	....	....	....	....	....	....	....	....
Gasoline	$10.80	$14.05	$13.85	$11.25	$13.03	$10.60	$ 7.48	$ 6.84	$ 5.52	$ 6.44
Lubricants	2.49	2.91	1.25	2.91	.15	8.55	11.59	....	....	6.19
Tires, tubes	....	....	4.65	....	....	2.15	....	....	11.50	....
Tires, shoes	....	....	30.90	....	35.25	....	....	....	....	....
Other supplies	....	....	3.50	....	1.50	.44	....	....	....	....
Repairs to machinery (routine)	....	....	1.30	....	....	21.08	5.25	17.98	16.90	....
Repairs to machinery (accident)	....	....	....	....	....	....	....	....	....	....
Repairs to body and frame (routine)	....	....	....	....	....	....	....	....	....	....
Repairs to body and frame (accident)	....	....	....	....	....	....	....	....	....	....
Repairs, miscellaneous	....	....	....	....	.30	....	3.25	....	....	1.50
Total monthly cost operation	$13.29	$16.96	$55.45	$14.16	$50.23	$42.82	$27.57	$24.82	$33.92	$14.13
Number of days in use	28	31	31	30	28	25	30	27	24	30
Number of days out of commission (in months)	2	None	None	0	3	5	1	4	4	1
Average daily mileage	37.2	38.2	38.3	34.1	38.0	35.9	25.0	30.0	20.0	30.1
Monthly mileage	1042	1186	1189	1023	1064	899	751	810	479	902
Operating cost per day in use	.474	.547	1.788	.472	1.704	1.712	.919	.92	1.41	.47
Operating cost per mile	.012	.014	.046	.013	.047	.047	.036	.031	.071	.016
Insurance (%)	$ 5.10	$ 5.10	$ 5.10	$ 5.10	$ 5.10	$ 5.10	$ 5.10	$ 5.10	$ 5.10	$ 5.10
Depreciation (%)	12.90	12.90	12.90	12.90	12.90	12.90	12.90	12.90	12.90	12.90
Interest on investment (%)	3.23	3.23	3.23	3.23	3.23	3.23	3.23	3.23	3.23	3.23
Taxes (%)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Total fixed charges	$23.23	$23.23	$23.23	$23.23	$23.23	$23.23	$23.23	$23.23	$23.23	$23.23
Total cost service day	$ 1.30	$ 1.24	$ 2.53	$ 1.24	$ 2.62	$ 2.64	$ 1.68	$ 1.78	$ 2.38	$ 1.25
Total cost per mile	.035	.034	.066	.036	.069	.073	.067	.059	.119	.041
Cost gasoline per mile	.010	.011	.011	.010	.012	.011	.009	.008	.012	.007
Miles per gallon gasoline	13.0	10.4	11.6	12.3	12.2	11.2	13.6	15.3	11.4	17.3
Cost lubricant per mile	.002	.002	.001	.002	.000	.009	.015	.000	.000	.007

to list all the companies using cars or all the makes of cars represented in telephone work, but rather to give some idea of the extent to which automobiles are in use at present in the operating field and the general satisfaction with which they are regarded by those who have occasion so to use them. It is safe to say

Group of Chase Motor Telephone Wagons.

that there is no telephone company which makes any extensive use of a vehicle of any kind but would find it of advantage to add to its equipment a small runabout or light delivery motor wagon, while the use of motorcycles for repair and maintenance work has become a matter of usual practice.

Telephones in War

The Japanese, in their advance toward Mukden, used field telephones with brilliant effectiveness. An equipment, consisting of the necessary instruments and big reels of wire something like hose carts, is now carried in the American army, so that there can always be direct communication in the field. Obviously, in modern battles where the range of the fire is so great and the commanding officer plans the battle as he would play chess, this idea is of enormous aid, says *Collier's Weekly*.

In Mexico a unique feature has been added to the role of this instrument in that the opposing generals were connected by telephone. They were furnished with service through an exchange of five thousand subscribers during the course of the battle at Juarez, Madero and Navarro signing contracts at the regular rental rate and being listed on the records as regular subscribers.

They directed many of the maneuvers by telephone, by recourse to "information," to furnish them the numbers at the various Jaurez addresses. The officers were able to submit their reports by telephone during the course of this battle by the simple means of breaking down a door or battering in a window. It was toward the close of the battle that General Madero called up his antagonist and demanded the surrender of the town. Again, when Navarro's life was threatened by the excited Revolutionists, Madero used the telephone to give strict orders to protect the opposing general. It was through the telephone, also that a temporary armistice to take care of the dead and wounded was arranged.

The telephone company records show that Madero used the instrument one hundred and sixteen times, to seventy-four for Navarro. The instruments in Jaurez were handled for the combatants in the same manner as a private wire, but *Collier's* has no knowledge about what happened when the operator reported "Busy," or "They don't answer."

Independents Connected With Chicago

"Hello, is this Aurora? Is this Mayor Sanders? How are you? This is Lawrence E. McGann, commissioner of public works of the city of Chicago. Greetings to you and Aurora from Chicago's city hall over the new independent telephone line."

This was the conversation which inaugurated the new independent long distance telephone connection between Chicago and the outside world through an extension of the Illinois Tunnel Company's automatic system.

The long distance connection with Aurora was completed and tested out at 8 o'clock Monday night, August 21, and Tuesday the Tunnel company invited Commissioner of Public Works McGann to hold the first conversation over the new system.

Mr. McGann's conversation with Mayor Sanders of Aurora was brief, but the former not only commended very highly the service rendered by the new connection but said Mayor Sanders also praised the splendid service and distinct enunciation obtained through the first official test.

The opening of the long distance connection of the automatic telephone marks the beginning of a lively competition between the Tunnel company and the Chicago Telephone Company, both in local and long distance service.

The extension completed to Aurora now makes it possible for any person on an automatic telephone in Chicago to talk to any point in Kane and Du Page counties, giving long distance connection with such places as Elgin, Batavia, Geneva, Naperville and intermediate points.

The Aurora extension was made by the Brennan Electric Construction Company. The construction of the Aurora extension was made under the supervision of R. P. Brennan. It was started on the morning of July 18 and completed on August 18, just one month.

It was declared that by October 1 the automatic telephones will have long distance connections with the following additional cities: St. Louis, Bloomington, Springfield, Peoria, Indianapolis, Clinton, Iowa, and all intermediate points.

Among the officials and other representatives of the Tunnel company who congratulated Commissioner McGann after his successful talk with Aurora's mayor were: C. O. Frisbie, president; J. J. Collister, assistant general manager telephone department; Alfred Slade, chief engineer; Charles H. Hood, general contract agent; H. D. Stroud, superintendent of service; Charles R. Peel, general superintendent of the Interstate Independent Telephone Company, Aurora; J. B. Russell, a heavy stockholder in the company; Fred Blocki and R. P. Brennan.

The Tunnel company distributed its telephone directory No. 7, which is more than twice the size of the previous number, containing 53,000 names. In addition to this the company has issued the first Chinese telephone directory ever printed in Chicago, this idea having been suggested by reason of the fact that the company's large number of Chinese subscribers more easily can find the numbers of business houses or commission houses in their own language than they can in English.

Germany, Switzerland and Italy have reached an agreement for the establishment of an international telephone line from Berlin to Rome direct.

What One Woman Thinks

By Sarah Elizabeth Brown

THE purpose of telephone operating—whether Bell or Independent—should in all respects be identical. The methods of operating telephone systems are similar; interests should be mutual and success should be interdependent. Competition is essential; but as relates to the telephone business, the contending factions regard each other as common foe. There are no other public serving institutions that ignore all the sensible and economic devices of cooperation. Banks are public servants. They are competitors. In the American Bankers' Association are 12,000 members. The clearing-house is the child of great institutions which vie with each other to get business. One telephone company wouldn't loan a pole to another! Co-operation in all other lines is essential to the highest success. In the telephone business it is death.

I have harped on this subject till my thumbs are sore. I have watched the game from an angle that tells me there is no hope for either faction of this business unless the bitter warfare ceases. The Bell company, in its practice to annihilate independents at any cost, will have itself to blame if independents retaliate. And that independents will fight to the last ditch is proven by a continuous record of years and years endurance.

* * *

I read a little while ago that there was nothing doing in the consolidation business in Michigan, because it was feared the law of the last legislature in that state would not hold in a higher court. I had something to say about the adverse criticism that fell upon the farmers who were responsible for the Michigan act. I must have got pretty close to the truth when I said the farmers were serving themselves and knew how to do it. The law seems to suit the farmers; but doesn't meet the approval of the merger promoters. While I'm about it, Mr. Kingsbury, who has charge of Bell manipulations in this direction, is quoted as saying: "The American Telephone and Telegraph Company is making combinations only when it can follow three general principles: First, that the combination be legal; second, that the public wants it; third, that it be commercially sound." The first condition, being placed first, must be the most important, for after all, it is the legal aspect that is interesting the big corporations nowadays. Personally, I believe that all the people are in favor of a single system—an interconnected rather than a dual service. And if these two conditions obtain, the proposition is sound, providing, always, that abuses have not been too glaring. The rub remains, however, that if the public is not satisfied with the new arrangement, whatever form it takes, it has recourse in asking another company to serve it.

* * *

This great shout of a monopoly on one hand and a great body of unorganized independent companies on the other is tommy rot. The Bell company isn't a telephone monopoly any more than any independent telephone company is a monopoly. The Bell does the best it can to serve a lot of people. It may want to serve all the people in the world, but it can't. The desire to serve everybody in four counties has been the ambition of our company, but we can't do it, so we serve what we can and let the other fellow have what we can't secure. Our ambition is monopolistic, but our service is good from one end of the system to the other and that is the vital thing. Can the man at Tamarack Station, Michigan, talk to his friend in Jerusalem, Ohio, and swear by the service, or will he swear at it? I fancy that it will be the latter. I have taken two extreme destinations in the Central Group of the Bell systems. There isn't the remotest possibility that the traffic of a telephone conversation can be carried universally and successfully in this group. And if not within a group of five important states, how about the whole country?

* * *

They still charge ten cents for hotel calls, both systems, in Cleveland. The United States Telephone Company's offices have been moved to Columbus. Lots of talk about merging down there, but it is a big, slow-moving problem and there will be dual service in Cleveland for some time to come.

* * *

The most excitement I can find in strictly independent telephone circles is that LaCrosse, Wisconsin, has bought a new board. That Chicago has connection with the Inter-State has been heralded as good news and doubtless it is something to rejoice about, but isn't it a little premature to shout about 2,000,000 additional connections with Chicago? I actually feel sorry for the people who try to make us believe the earth whirls around on its axis three times every twenty-four hours. The telephone business, as a whole, is slow going, patient and reliable. Certain significance attaches to the tying in of the wires of the Inter-State and Illinois Tunnel Company, but it doesn't mean that 4,500,000 people can start interstate commerce over the system. Time will be required to perfect such an arrangement, for you must fuss a terrible lot with delicate circuits and sensitive apparatus before you can do a great amount of talking. And I feel just a little dubious about the thing that happened up Aurora way something over a year ago, when Hank Evans and Wagner and Cheadle and the Watson estate were selling bundles of Inter-State bonds to unknown parties at 60 cents on the dollar. It was even alleged that Uncle Hank got par for his'n—something like half a million dollars' worth. At any rate, the system that wasn't worth a whole lot under Evans seems to be a regular hum-dinger since he let go and Hank has been doing the other half of the hemisphere ever since. So I can't enthuse on this proposition, though I've waited long and patiently for its culmination. But I've always been frank as an openface watch, confessing always that I can't comprehend when I deal with millions. I shouldn't be blamed then, for wondering what became of those Inter-State bonds.

* * *

Over in Louisville, the gossips have it that the Cumberland is absorbing the Home company. A

like report says that the Kinlock is being swallowed up by the Missouri Bell. In Detroit there is a pussy-footed movement that puts the Home Company under suspicion. These late summer zephyrs seem to be carrying a peak load. Excluding Louisville, and adding Kansas City to this group, I find myself confronted with a coterie of financiers whose homes are in St. Louis and who have put a lot of money into Independent telephone enterprises. There is included in their investments a certain telephone manufacturer, the bulk of whose business has rested with these big operators of metropolitan plants. I am crazy to know how these big properties can be manipulated without slipping the independent manufacturer into the discard. A woman's insatiable curiosity is my only excuse for the thought.

* * *

In Akron, Ohio, the People's company will buy the Bell system. Akron's "fire-eaters" were bound to have it that way and they got what they wanted. It is one of the first of the consolidation announcements coming under Ohio's new law. Now will the Akron People's buy its supplies in an open market at a business-like price or will it buy on a sentiment basis? In looking through the pages of Telephone Engineer, I find only two independent telephone manufacturers' advertisements. Is that all there are left, or must we find out what is doing among the old guard in their old rallying place? I'm beginning to think that some people—only a few—mostly manufacturers—believe in this no compromise thing. They want conflict—not competition. They want the whole hog or nothing. They believe there is no conciliable ground—that if they win the other fellow must fail. That if they fail the other fellow must win. Oh, shucks, sensible men don't believe such stuff at all. It is a mental condition. It isn't true sporting blood!

* * *

Why must we take the alleged Mackay interest in independent telephone affairs seriously? Every little while we are treated to an exciting short story that the Postal Telegraph Company is coming into the telephone field with new uniforms and brass bands. And why the Postal Telegraph Company at all? Wasn't the name changed to Transcontinental Telegraph Company about a year ago? Seems to me I saw something of this sort. Like others, I wondered why the old name was cast ruthlessly aside for the higher-toned one, but the old Postal was nothing more than the scattered land-ends of an oceanic cable service. I have it upon good authority that their subsidiary companies have only paid dividends when the Mackay companies needed the money. The big producer is the Commercial Cable Company, owning more than 30,000 miles of cable lines. It is the biggest aggregation of cables under single ownership in the world, earning as nearly as can be ascertained $3,500,000 annually. Because the Mackay companies are successful in their wire operations, may be cause for the ever recurring statement that it is about to buckle on the armor and enter the "no compromise" game, but I'm of the opinion that this is one concern that has found a better way to make money than to dabble with any dog-eat-dog affair. If prayer would efface the waste of telephone warfare, I'd go down on my knees right now and go after the long-distance record of supplicating the Almighty.

I wish that I were competent to analyze the A. T. & T. Company's reports. I have before me the semiannual dope sheet that seems to indicate an increase in gross earnings of about a million a month for the first six months of 1911. The total earnings for the first six months of this year aggregate approximately the annual earnings of 1906. The amounts in dollars and cents are extraordinary, running into millions and it isn't reasonable to suppose that the feeble-minded who follow me would know what I was trying to get at if I put the figures down. There is a lot of the usual stuff about interest and other revenues from associated companies—sums due to exchange of advances—comparisons, this year on the basis of the first six months, with all the years for half a decade—whole columns of dollar-signs and figures. I doubt whether brokers ever waded into the array. I can comprehend that there is a tremendous activity; an ever expanding, ceaseless grinding, monstrous institution; bigger today than it was yesterday. And through the maze of it all comes the reassurance that the telephone business is some whale of a business, able to stand for more knocks; more extravagances; more jiggling and juggling than anything in baby industries that has ever been found. The beauty of it is, it gets away with it. Its securities grow stronger; its dividends are stable; it affords pleasant occupation for countless thousands and its credit is unimpeachable. Cut out the politics and the telephone business would be a near approach to paradise.

* * *

Have you talked to Aurora yet?

Whole Telephone System in Window Display

In a window display recently placed in the large show windows of the Titche-Goettinger department store at Dallas, Tex., a two-position private branch switchboard was placed in one end of the window, two wax figures representing operators being placed at the switchboard, says the *Southwestern Telephone News*.

A figure in the center represented a patron using the telephone service of the store in its rest room, which is provided for the convenience of patrons.

Telephone sets were distributed throughout the window and attached to each telephone set was a card showing the different departments. Grouped around each telephone set was merchandise symbolic of the respective departments; and at each telephone set were arranged small incandescent lamps connnected to a flasher, so that the lamps would flash at intervals over the entire window.

Ribbons leading from the telephones were run into a cable strung from pole to pole, this cable terminating on the private branch exchange switchboard. Wires at the end of the pole line were brought to a large map of the state of Texas, terminating at different towns; this feature being intended to show up the long distance service.

Appropriate signs were displayed throughout the window, showing the number of telephones connected in the city of Dallas and within a hundred-mile radius of Dallas. Other signs called attention to the fact that out-of-town orders over telephone are given prompt attention by this store, and other signs featured the local telephone number of the store.

Multiplex Telephony and Telegraphy*

By Major George O. Squier

DUPLEX TELEPHONY, USING METALLIC CIRCUIT.
(A) BRIDGING ARRANGEMENT.

THE next experiments pertained to the standard metallic circuit as universally used on telephone toll lines in congested districts. The electric constants of this line have already been given.

The next step was to remove entirely the earth connections from the metallic circuit and superimpose both telephonic circuits upon the same pair of wires, as shown in Fig. 6, in which the high-frequency apparatus, shown diagrammatically in Fig. 5, is bridged across the line wires A and A'. G is the source of sustained high frequency oscillations; C_1 is the tuning condenser of the oscillatory circuit; L_1 is the tuning coil of the oscillatory circuit; P is the primary of the oscillation transformer; A is the ammeter; M is the transmitter miscrophone; S is the secondary of the oscillation transformer in the line circuit; C is the tuning condenser in the line circuit; L is the tuning inductance in the line circuit; A_1 is the ammeter in the line. At the receiving end of the line, C' is the line tuning condenser; L' is the line tuning inductance; P' is the primary of the oscillation transformer; S' is the secondary of the oscillation transformer; L'' is the tuning inductance in the oscillatory circuit; C'' is the tuning condenser in the oscillatory circuit, between which and the telephone F the detector D is operatively connected.

The local battery telephone sets are connected across the line wires in the usual manner. In both sets, *1* is the microphone transmitter; *2* is the local battery; *3* is the induction coil; *4* is the ringing system, including the bell and hand generator; *5* is the switch hook; *6* is the telephone receiver.

Since the high frequency apparatus as commercially developed in the wireless telegraph art was used, each of the units was variable and had been previously carefully calibrated.

The transmitters first tried were those of the microphone type inserted in the armature circuit of the dynamo and provided with water cooling when currents of several amperes were to be used.

It was soon found, however, that the efficiency of

Fig. 5.

transmission of this cable line was so good for electric waves of these frequencies that a very small current, in the neighborhood of two milliamperes, sent into the line was amply sufficient for good speech at the receiving end about seven miles distant. No attempt was made to determine to what lower limit the transmission current could reach in this respect, but such small currents enabled the ordinary telephone transmitter to be used without any provision for cooling, especially when it was inserted in the line circuit, instead of in the oscillatory circuit of the dynamo.

The telephone receivers were those regularly furnished for wireless telephony, ranging in resistance from 2,000 to 8,000 ohms.

Resonance. As was expected, the phenomena of resonance under the conditions which here obtained were very pronounced and highly consistent, since there is here

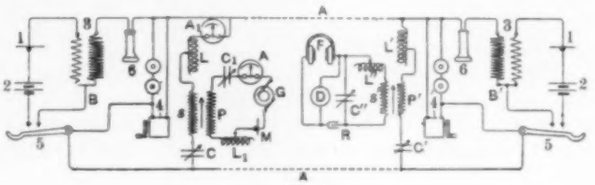


Fig. 6.

a definite circuit free from the disturbances and variations inherent in radio telegraphy and telephony.

In general, the different circuits were tuned to resonance in the same manner, for the same purpose and with the same effect as in wireless telephony and telegraphy.

The line circuit itself was readily tuned to resonance for the particular frequency of the dynamo by noting the maximum reading of the hot wire ammeter A_1 in the line itself. This maximum is readily found by varying either the capacity C, or the inductance L, or both.

At the receiving end of the line, coil L' and the condenser C', as well as the coil L'' and the condenser C'', were tuned to give a maximum intensity of signals in the receiving telephone of the audion.

The audion, a detector of the so-called vacuum type, consists of an exhausted bulb containing (*a*) a tungsten filament maintained at incandescence by a current from a local battery of six volts and (*b*) two platinum electrodes insulated from the filament and from each other. To these electrodes, one of which is a platinum plate and the other a platinum grid, there are applied through the high resistance receivers about 35 to 45 volts from a local battery. The brilliancy of the filament is controlled by a small series rheostat, and the voltage applied to the insulated terminals by a local potentiometer.

The gases in the bulb, becoming ionized by contact with the glowing electrode, serve as a conductor of electricity, having a high unilateral conductivity. If the platinum wire grid is close to the hot filament and the plate at some greater distance, the direction of greater conductivity is from the plate through the gas by the ionic path to the grid, so that if the positive terminal of the telephone battery is applied at the plate terminal and the negative at the grid terminal, a sufficient current to operate the telephone will flow.

If the terminals of the condenser of a resonant receiving circuit are connected to the grid and one terminal of the filament the high frequency e.m.f. impressed from this resonant circuit will cause a greater current to flow through the gas in one direction than in the other, as in the case of the direct-current potential applied through the telephone receiver. This rectifying effect will be re-

*Paper presented at the 28th annual convention of the American Institute of Electrical Engineers. Concluded from August.

produced in the telephone receivers, causing them to make audible the received signals.

By changing the coefficient of coupling or the potential across the audion, which is adjustable, or the amount of ionization of the gases in the tube by adjusting the current through the filament, or any combination of these, it was found that the receiving operator could bring out the speech to suit his particular fancy.

As stated above, the dynamo operated regularly at ranges from 100,000 cycles per second down to 20,000 cycles per second. It was therefore possible to try the effect of a comparatively wide range of frequencies in these experiments, covering three octaves, the inductances and capacities being chosen to correspond to each particular frequency. It was found that more energy was delivered over this particular type and length of circuit by using the lower frequencies of this range than the higher ones, although efficient results were easily obtained at any point.

The battery telephone side of the equipment was left absolutely intact, as it would be commercially used, and severe tests were made, employing four operators, to determine the efficiency of two simultaneous conversations over this same pair of wires.

The ringing circuit was operative both ways with no apparent effect on the high frequency telephone transmission. This ringing circuit develops a comparatively large alternating current flowing in the wire at about 30 cycles per second and at a voltage of many times that of either the high frequency or the battery side of the circuit.

Articulation tests, including music, numerals and other difficult combinations, gave satisfactory results, with no interference whatever between the two sides of the circuit.

By holding one telephone receiver to one ear and the other receiver to the other ear the receiving operator could hear two entirely different conversations simultaneously over the same pair of wires.

(B) SERIES ARRANGEMENT.

A circuit was next made up with high frequency apparatus inserted directly in the line in series, instead of in the bridging arrangement shown in Fig. 5. The circuit used is shown diagrammatically in Fig. 7, in which L and L' are the secondary coils of the transmitter and receiver, respectively. C and C' represent variable condensers of the order of magnitude used in wireless telegraphy and

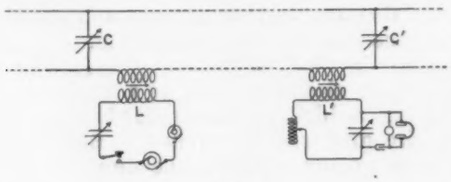


Fig. 7.

serve as low impedance paths for the high-frequency oscillations, and at the same time prevent the short circuiting of the low-frequency battery telephone current. It was found that this arrangement gave apparently as good results as the bridging arrangement of the circuit.

III. DUPLEX-DIPLEX TELEGRAPHY.

Having described in detail the experiments for obtaining the simultaneous transmission of two telephonic messages over a single circuit, it will be apparent that the problem of transmitting two telegraphic messages over the same circuit may be solved by methods and apparatus as far as the high frequency side of the circuit is concerned, which are practically identical with those described above.

In this connection the metallic circuit referred to was equipped with a standard Morse set for manual operation, and upon this circuit was superimposed an equipment for transmitting in one direction telegraphic messages by means of sustained high frequency oscillations, employing the telephone as the means for receiving the signals. The circuit used is shown diagrammatically in Fig. 8, in which, in the Morse set, there are shown between the line wire and the ground G, the line relay S, the key K, and the line battery B; and the local battery b and the sounder s; and in which, in the high frequency set, are similarly shown between the line wire and the ground G the tuning elements C and L; and at the transmitting end the oscillation transformer T, the primary of which is in circuit with the dynamo as a source of sustained oscillations, the telegraph key K', the interrupter I and the tuning elements C' and L', and at the receiving end the oscillation transformer R in the secondary cicrcuit of which are included the usual tuning elements and operatively connected to them the detector and its telephone as a means of receiving the signals.

As noted in the case of the preliminary local circuit tests, it was found that over this particular line it was not necessary to use a detector for electromagnetic waves, since enough energy was delivered to operate the telephone receiver directly without any tuning by connecting it between the line and the earth.

The sound produced, however, was characteristically different in the two cases. With the detector the individual signals and the characteristic tone corresponding to the interrupter at the transmitting end of the line, whereas without the detector this tone was entirely absent, and a general dull sound, due to the resultant action of the wave-trains was heard. If, however, a telephone receiver was employed with a soft iron core, instead of a permanent magnet, no result was obtained with the limited power used on this line.

Although little mention of telegraphy by high-frequency electric waves has been made thus far, as a matter of fact it was found convenient during the experiments upon telephony actually to employ telegraphy as a quick and ready means of determining resonance between the circuits in each particular case.

When any particular arrangement was being employed the first steps were invariably to send simple Morse signals over the circuit until the operator at the distant end of the line reported maximum loudness in the receiving telephone, which indicated that the terminal apparatus with the line circuit was properly tuned. This being accomplished it was only necessary to throw a switch, which substituted for the automatic interrupter and telegraph key, the telephone transmitter. The experiments could then proceed on telephony without any material change being made at the receiving station. Telephony and telegraphy thus proceeded hand in hand as a mere matter of convenience, and one of the practical advantages in the use of electric waves for transmitting intelligence is that the whole set-up of apparatus is practically the same for each and they can be used interchangeably over the same circuit.

Considering the Morse equipment, indicated in Fig. 8, the electromagnetic units involved are of the order of magnitude of microfarads and henrys, and the period of the direct interrupted current for Morse sending is not more than the equivalent of about 10 complete cycles per second, whereas in the high frequency side of the circuit the electromagnetic units are of the order of magnitude of thousandths of a microfarad and of thousandths of a henry and with frequencies not less than 2,000 times greater than those involved in manual Morse sending. Furthermore, the ohmic resistance of the line which plays a prominent part in limiting the distance and speed of Morse working, is comparatively unimportant in the case of electric waves guided by wires. The operation of the line equipped as in Fig. 8 was perfectly satisfactory, there being no perceptible interference between the two messages in either direction.

Since the standard telegraph circuit of the world uses a ground return circuit, this same equipment was arranged to operate on one of the wires of the twisted-pair in the telephone cable as such a circuit, with earth connections at each end, and its operation was equally successful.

Since it is a well known characteristic of high frequency apparatus used in tuned circuits that there shall be no iron involved in the circuit, it is evident that in cases where such a high-frequency circuit is to be superimposed upon a line comprising way-stations, where line relays are inserted directly in the circuit, it will be necessary and sufficient to shunt such way-stations by condensers of the order of magnitude of thousandths of a microfarad. Such condensers offer a comparatively free path for the high-frequency electric waves, but interpose a practical barrier to the Morse frequencies.

The same general statement can be made relative to any of the standard forms of low-frequency telegraphy over wires as now practiced, such as the polar duplex, the differential duplex, and the duplex-diplex employing alternating currents of low frequency and standard keys, relays and sounders.

Inserting a regular 150-ohm telegraph relay in series in the line cuts down the high frequency current to a small percentage of its original value, which indicates the marked influence of the presence of iron in such a circuit. Furthermore, it was noted that at 100,000 cycles the hysteresis of the iron core at this period was so great that it became heated very perceptibly in a few moments.

Since a portion of the telegraph lines now used is still composed of iron wires, it would be expected that electric waves would be propagated over such wires less efficiently than over copper wires, since it is well known that electric waves penetrate only about one-thirteenth as deeply into soft iron for a given frequency as into copper, although this is modified by the fact that the iron in telegraph wires is not soft iron and in addition is galvanized.

SUMMARY.

Radio-telegraphy has no competitor as a means of transmitting intelligence between ships at sea and between ships and shore stations, and on land it is also unique in its usefulness in reaching isolated districts and otherwise inaccessible points. To what extent it may be also developed to furnish practical intercommunication according to the high standard now enjoyed in thickly populated districts, it is not attempted to predict.

The foregoing experiments indicate that either the existing wire system, or additional wires for the purpose may be utilized for the efficient transmission of telephonic and telegraphic messages, and the former without interfering with the existing telephone traffic on these wires.

The fact that each of the circuits created by the use of super-imposed high-frequency methods is both

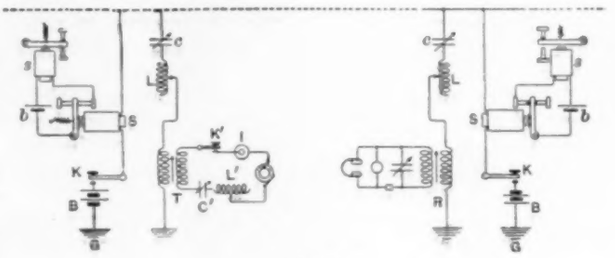


Fig. 8.

a telephone and a telegraph circuit interchangeably, makes it possible to offer to the public a new type of service which, it is believed, will offer many advantages to the commercial world. This type of circuit should be particularly applicable to press association service, railroad service, and leased wire service of all kinds.

The experiments described should not be interpreted as in any way indicating limitations to radio-telegraphy and telephony in the future, for their present rapid development gives justification for great prospect for the future. It is rather considered that the whole system of intercommunication, including both wire methods and wireless methods, will grow apace, and as each advance is made in either of these it will create new demands and standards for still further development. We need more wireless telegraphy everywhere, and not less do we need more wire telegraphy and telephony everywhere, and, again, more submarine cables. The number of submarine cables connecting Europe with America could be increased many times, and all of them kept fully occupied, provided the traffic were properly classified to enable some of the enormous business which is now carried on by mail to be transferred to the quicker and more efficient cablegram letter. That time will surely come when the methods of electrical inter-communication will have been so developed and multiplied that the people of the different countries of the world may become real neighbors.

Accustomed to the methods of transmitting energy for power purposes by means of wire, it is a matter of wonder that enough energy can be delivered at a receiving antenna from a transmitting point thousands of miles distant to operate successfully receiving devices. The value of a metallic wire guide for the energy of the electric waves is strikingly shown in the above experiments, and it furnishes an efficient directive wireless system which confines the ether disturbances to closely bounded regions and thus offers a ready solution to the serious problems of interferences between messages which of necessity have to be met in wireless operations through space.

The distortion of speech, which is an inherent fea-

ture of telephony over wires, should be much less, if not practically absent, when we more and more withdraw the phenomena from the metal of the wire and confine them to a longitudinal strip of the ether which forms the region between the two wires of a metallic circuit.

The ohmic resistance of the wire as shown can be made to play a comparatively unimportant part in the transmission of speech and the more the phenomena are of the ether, instead of that of metallic conduction, the more perfectly will the modified electric waves, which are the vehicle for transmitting the speech, be delivered at the receiving point without distortion.

It has been shown that the phenomena of resonance, which are met with in so many different branches of physics, exhibit very striking and orderly results when applied to electric waves propagated by means of wires. By utilizing this principle it has been shown that the receiving current at the end of the line may be built up and amplified many times over what it would be with untuned circuits.

The tuned electrical circuit at the receiving end readily admits electromagnetic waves of a certain definite frequency, and bars from entrance electromagnetic waves of other frequencies. This permits the possibility of utilizing a single circuit for multiplex telephony and telegraphy.

New York Commission Notes

The New York Public Service Commission, second district, has a novel proposition put up to it by Rev. William N. Hubbell, pastor of Mariners' Temple, Oliver and Henry streets, New York City. Mr. Hubbell asks the commission to require telegraph and telephone companies to cut off service between race tracks and pool rooms.

Mr. Hubbell in his complaint says, after noting the evils of pool rooms and the ineffectual efforts of the police to rid the community of their presence, "It seems to me you have the power to put an end to these gambling dens. Authority has been given you by the legislature over the telephone and telegraph lines of the state. These pool rooms could not flourish if they were cut off from direct communication with the race tracks. The responsibility for the installation of these means of communication rests with the directors of these companies, as was proven in an investigation made several years ago.

"Strange that these directors, estimable gentlemen in their private relations, should be, morally, parties to a system which robs thousands of people of their earnings. Yet it is so, to their shame. But can you not end this situation by the exercise of your authority over the telephone and telegraph companies?"

The commission has asked its counsel to look into the question of what, if any, power it has to deal with this matter.

The commission has made its final order in the matter of interborough telephone rates of the New York Telephone Company in Greater New York.

An order was made June 1, 1911, reducing various rates which carried reductions of from 10 cents to 5 cents for messages between Manhattan and Brooklyn and between Manhattan and central station districts, Astoria and Newton on Long Island, and reductions from 15 cents to 10 cents for messages between Manhattan and central station districts Flushing, Richmond Hill and Jamaica, on Long Island. The New York Telephone Company asked for modifications of the order and the final order now provides for a 5-cent rate instead of 10 cents between Manhattan below 110th street, west, and 103rd street, east, to that section of Long Island included between the Long Island Sound, East river, New York Bay and a line beginning at 65th street and New York bay following the route of the Bay Ridge Extension & Manhattan Beach division of the Long Island Railroad easterly from New York bay to New Lots avenue; thence easterly on New Lots avenue to Fountain avenue; thence northeasterly to the intersection of Blake avenue and Crystal street extended; thence easterly on Blake avenue to the boundary line between the boroughs of Brooklyn and Queens; thence northerly on the boundary line between the boroughs of Brooklyn and Queens to Forest Park; thence north across Forest Park to a point 100 feet south of Myrtle avenue; thence easterly and parallel to Myrtle avenue to a point 100 feet easterly and parallel to Myrtle avenue to a point 100 feet east of Dry Harbor road extended; thence northerly and parallel to Dry Harbor road through St. John's cemetery to a point 100 feet south of North Hampstead road; thence northeasterly along North Hempstead road and 100 feet therefrom as far as Flushing Creek; thence northerly along Flushing Creek to Flushing Bay. It also provides for a 10-cent rate instead of 15-cent between Manhattan, between 110th street west and 103rd street east, to central station districts Flushing, Richmond Hill and Jamaica upon Long Island.

These rates apply from regular subscribers' stations for a connection of five minutes or less and each additional five minutes or fraction thereof may be charged as another call.

To give the company a reasonable time to provide for the additions to its plant and equipment which increased service following reduced rates is sure to demand, the company is given until December 1, 1911, to put the reduced rates in effect.

The company has agreed to the terms of the order as now made.

Foresters' Portable Telephone Designed

C. A. Starkweather, who has been conducting experiments in the Pecos forest with various telephone appliances, has rendered his report to Forester A. C. Ringland, and the report was forwarded to Washington for approval. Mr. Starkweather will establish telephone lines in several of the forests throughout the west.

The most important result of his experimentation on the Pecos is the perfection of a ten-pound model portable telephone to be carried on the saddle for the use of forest rangers. This telephone is perfect in its operation and can withstand any amount of hard usage. It has batteries for a long life, the smallest so far perfected for practical telephone use. The weight of the portable outfit has been reduced eight pounds from that of the models at present employed. With it connections can be made instantly by cutting in on any portion of the line.

Severe tests of the endurance properties of a special insulated wire were made. The wire proved satisfactory under the roughest usage and will be adopted for emergency lines. It will be used on reels and strung along the ground in burning forests, making a quick and easy means of communication for fire fighters. It was used under water and under severe conditions of heat and strain.

The Telephone Scrap Book

Pennsylvania Railroad Concrete Pole Line

THE meadows section of the Pennsylvania Railroad entrance to the new terminal station in New York City is a 5-mile continuous stretch of semi-tidal meadow swamp land, except for a short section of rock outcropping at Snake Hill, according to a paper by

Pennsylvania Railroad—Reinforced Concrete Telegraph Pole.

George Gibbs, entitled "The New York Tunnel Extension of the Pennsylvania Railroad: Station Construction, Road, Track, Yard Equipment, Electric Traction and Locomotives," to be presented before the American Society of Civil Engineers, Oct. 18, 1911, and printed in the *Proceedings* for May, 1911, page 636. The Hackensack River is crossed midway of this section. The ground surface is covered with a heavy growth of reeds, and the top stratum is a peaty bog, from 8 to 15 feet deep, underlaid with varying strata of clay, fine sand, and mixed sand and clay for very considerable depths. Across this section, and adjoining the track embankment, a pole line was erected for telegraph and telephone purposes, and one for the high-tension power wires.

Ultimately, the telegraph and telephone service will require sixty open wires and two 40-pair cables, and it was desired to make this line entirely secure against probable interruption by severe storms or fires in the swamp reeds. The character of the foundation, as indicated, was bad, and, after much consideration, it was decided to substitute for a wooden pole line, which would be inadequate for the conditions, one of concrete poles, which, while somewhat experimental and perhaps somewhat more costly, would provide a safe and durable construction.

In this section 202 poles were required. They were spaced from 70 feet to 135 feet apart, with an average standard span of 120 feet, the variations in span being due to the numerous railway and highway crossings. The heights of the poles above the ground vary from 25 feet to 50 feet, and they are from 35 feet to 65 feet in total length.

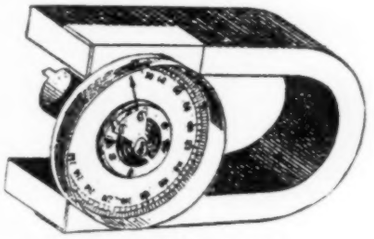
The design, made by R. D. Coombs, structural engineer on the staff of the chief engineer of electric traction, called for transverse loading conditions, in case of maximum storms, equivalent to 6,000 pounds at 6.5 feet below the top of the pole for the 120-foot span length. The poles are square in cross-section, with chamfered corners and with a taper of one-half inch in 5 feet. The 1:2:4 concrete mixture of which they are made was assumed to have an ultimate unit strength, in compression, of 2,200 pounds. The reinforcement is composed of mechanical bond bars tied together into a square skeleton frame. In the complete pole this reinforcement is covered by a 1-inch minimum thickness of concrete. The skeleton reinforcement was placed in horizontal frames, and the concrete mixture was poured in and carefully tamped. A special yard was established near the line, in which to make, store and season the poles. The average number of poles made per day was six, and they were left in place sixteen days to season.

After a number of experiments, it was found best to set the poles in pits excavated in the marshy stratum. These pits were generally about 9 feet square and 5 feet deep, and a timber grillage was placed around the base of each pole and about 5 feet below the top of the ground. This grillage consisted of six track cross-ties bolted together and to the pole, and partly planked over by 3-inch rough lumber. The pole, which projected below the grillage and was pointed at the butt, was jetted down by compressed air into the sandy layer, so that the grillage would rest at the bottom of the pit. The pits were then backfilled with rock and clay. Poles on curves are cross-guyed, and the terminal and railway crossing poles are head-guyed with steel cables.

Because of the unusually heavy line and the extra length required for the foundations, the gross weight per pole, exclusive of grillage and cross-arms, is more than would be required for ordinary telegraph poles, and varies from 5,300 pounds for a 35-foot pole to 17,300 pounds for poles 65 feet in length.

Measuring the Strength of a Magnet

THE comparative strengths of horseshoe magnets and the gradual loss of strength by the same magnet can be easily measured with a simple magnetoscope, consisting of a graduated disk which is attached to a



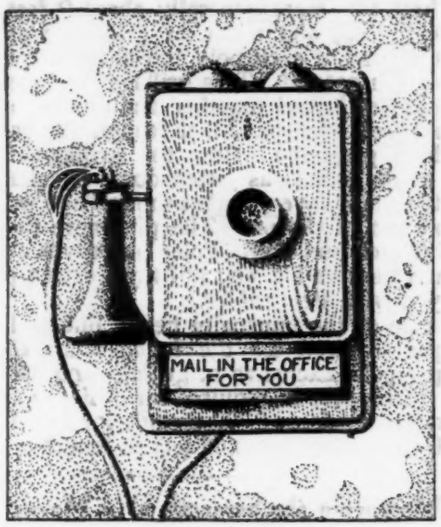
A Simple Magnetoscope.

shaft turning on bearings in a bridge connecting the poles of the magnet, according to *La Nature*. At the center of the disk is a steel needle, which is brought back to the zero mark by a spiral spring. All parts ex-

cept the needle are made of brass or other non-magnetic material. The instrument is placed with the zero mark opposite one pole of the magnet and the disk is turned until the force of the spring overcomes the attraction of the magnet, when the needle suddenly flies back to the (displaced) zero. The number of the scale division at which the needle stood immediately before the rupture of equilibrium is a measure of the strength of the magnet. This number may be inscribed on the magnet to serve as a standard of reference in comparing it with other magnets and in future tests made for the purpose of determining whether, and to what extent, it has lost magnetism.

A Hotel Convenience

IN the high class hotels in the larger cities electricity is made to perform a great many little services for the patron, which in the aggregate tend to impress him with the fact that no expense has been spared to make everything convenient and comfortable. For instance, says *Popular Electricity,* he will find in such a hotel that under the telephone in his room there is a slightly convex case of opaque glass. Suddenly he may be surprised to see the case light up from within and to read the words "Mail in the office for you," the letters being painted on the inside and only visible when the electric light within is turned on. Inquiring later at the office he finds that the mail distributing rack back of the clerk's desk is fitted with little shutters to each compartment. When a letter is thrust into a compartment the shutter is pushed back and this closes a circuit leading to the lamp in the corresponding room.

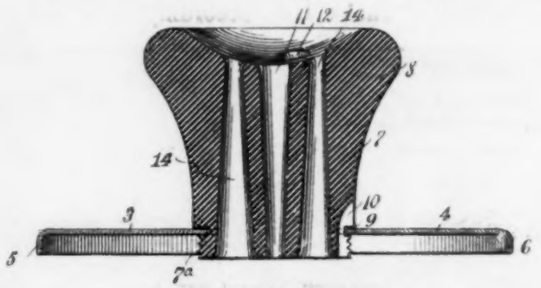


"Mail in the Office" Signal.

Improvements in Mouthpieces

THAT improvement is possible in the present form of the telephone transmitter mouthpieces is the idea on which is based a series of patents recently issued to Louis Steinberger of New York. The illustration shows a cross section of only one of the new mouthpieces. The idea is to improve the acoustic properties of the horn, and at the same time provide a form of construction that will prevent chipping or breaking away of portions of the shell.

As seen by the cross section, the mouthpiece is provided with a number of separate passages, each having the form of a cone frustum, the ends of the passages, however, being rounded, and the various individual passages being so disposed that the larger end of one passage extends in the same general direction of the smaller end of another passage. This arrangement of the passages is claimed to preserve, and practically to increase, the sound vibrations transmitted through the various passages. By this arrangement some of the passages are said to concentrate the sound waves at a point adjacent to the diaphragm, while other of the passages expand the sound waves at a point adjacent to the diaphragm.



A New Form of Mouthpiece.

Another feature is that glass, porcelain or other brittle material may be employed with good effect. When such materials are employed the mouthpiece becomes hygienic, as it may be boiled in water or other liquid, or cleansed in acids, alkalis or other disinfecting solutions.

The inventor claims to have made the discovery that many mouthpieces now in common use are exceedingly wasteful of the energy of the sound vibrations associated with them; also, that by giving the mouthpiece a proper conformity hereinafter described, the effectiveness of the mouthpiece, from an acoustical standpoint, may be greatly increased.

The invention is based upon the idea that a passage of substantially frusto-conical form, if placed with its portion of smallest diameter in immediate proximity to the center of the piaphragm, avoids the undue production of over tones, and causes the diaphragm to vibrate as nearly as possible under the influence of the principal harmonics, thereby increasing the loudness of the sounds.

Loading Coils

WHEN telephone engineers began to take up the problem of long distance it was found that satisfactory transmission could not be effected over a very great distance, even when the size of the wire was made very large; it was then seen that factors other than line resistance entered into the problem,

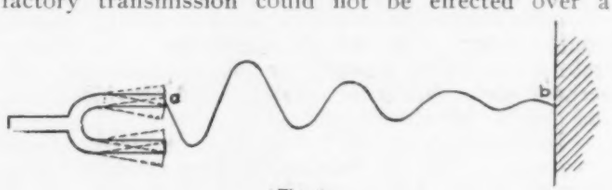


Fig. 1.

says the *Telephone Review*. Experiment showed this to be so, it being found that the self-inductance and capacity of the line affected its efficiency. The closer the two wires and the longer the line, the greater the capacity became, while increasing the space between the wires increased the self-inductance and improved the transmission.

Induction, therefore, was an advantage, while ca-

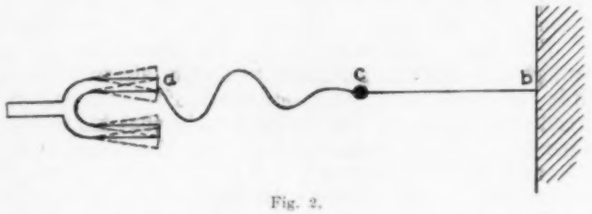


Fig. 2.

pacity was a disadvantage. But how could the capacity be decreased and the inductance increased? A solution of this problem was accomplished by Prof. Pupin by means of what we call "loading coils" or "Pupin coils."

In a long transmission line carrying alternating current, the impulse goes along the wires in waves. The length of these waves varies with the conditions of the line, and may be anywhere from 10 to 100 miles. This action is analagous to that of a string set in vibration by a tuning fork and fastened rigidly at one end. If the fork is kept vibrating, the string takes a form like Fig. 1.

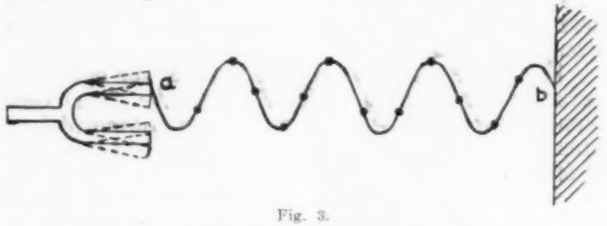


Fig. 3.

As will be noted the vibrations are smaller, as the point (b) of support is approached. This gradual diminishing of amplitude (height) of vibrations is known as attenuation. It is shown on a transmission line as a diminution of current. If a heavier string is used, or a more elastic one, the attenuation is not so great. But suppose the string be made heavier by placing a weight at the middle of the point, as in Fig. 2.

Instead of decreasing the attenuation, the weight acts as a drag, preventing the vibrations from passing. On the other hand, suppose several light weights are placed at short distances along the string; then the vibrations are not impeded and the attenuation is decreased.

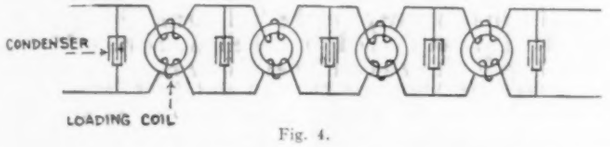


Fig. 4.

Now, in the transmission line, resistance corresponds to the friction, capacity to the elasticity; and inductance, the weight of the string.

The resistance of a given line is constant for a given size of wire; the capacity is constant for a given pin spacing and height above the ground, therefore, the only factor that can be changed is the inductance. As in the case of the number of small weights on the string, if numerous small inductances are placed all along the line, at certain regular intervals, it will give an effect approximating uniformly distributing inductance.

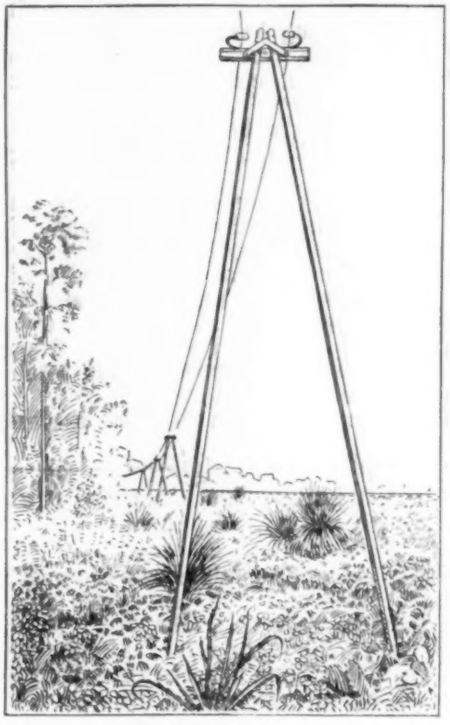
Since the capacity is distributed through the whole length of the line, and may be represented by condensers placed across the line, the inductance, to properly neutralize this capacity, must also be distributed. The "loaded" trunk might be represented by diagram Fig. 3.

The coils are of copper wire wound on a circular core comprised of small insulated iron wires. There are two coils wound in opposite directions on each core, and each side of the line is placed in series with one of the windings. In general, forty-nine of these coils are encased under one cover, termed a "loading-pot," so that forty-nine pairs may be loaded at the same point.

Due to the action of loading coils we are enabled at present to talk through underground cable between New York and Philadelphia and between Chicago and Milwaukee.

Old Iron Rails Used for Poles

IN building the Madeira-Mamoré Railway in Brazil, says *Popular Mechanics*, it was found impracticable to use wooden telegraph poles on account of the ravages of tropical insects. The difficulty was solved by utilizing old iron rails placed in pairs meeting at the top, as shown in the illustration.



Poles Made of Old Iron Rails.

The most destructive of the various wood-boring insects found in this part of South America is the "cupim," which builds a nest or a shaft of mud over the bark of trees or wooden poles, and honeycombs

them in a manner similar to the "teredo" or "shipworm," which is so destructive of submerged timberwork in tropical seas.

One-Man Cable Test

VERY few electricians and cable splicers know how to test dead cables without a helper, and as an experienced helper is not always at hand, the following method, described in *Popular Mechanics* by G. M. Peterson, may be of value.

The example used for illustration is a small telephone cable which has been "cut in" at random on the main distributing frame. It is understood that the cable is not "code," that one side of the pair is

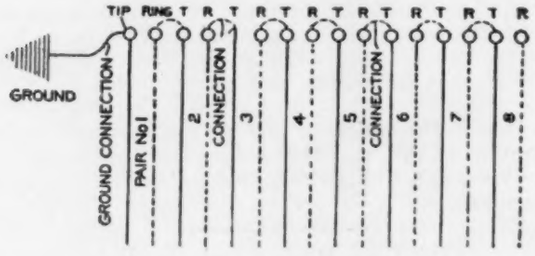


Fig. 1. Main Distributing Frame.

a solid color, while the other side is white. After "cutting in" the cable on the main distributing frame or box, the tip of the pair No. 1 is grounded. The ring of the pair No. 1 is connected to the tip of the pair No. 2, and the ring of No. 2 to the tip of pair No. 3 and so on through the cable as shown in Fig. 1.

The cable having been connected up as shown, the tester enters the manhole, opens the cable, clears the ends of the wire, and connects up as shown in Fig. 2 with a head receiver in series with a battery. The other side of the battery is connected to the ground. A search line is attached to the open side of the receiver.

Test out by touching each wire with the search until a loud click is heard in the receiver. This will be pair No. 1. The battery lead is now removed from the ground and placed on the ring wire of No. 1. Touch the ends with the search wire as before and pair No. 2 will be tested. Place the battery wire on the ring wire of No. 2 to test out No. 3 and so on through the cable, putting each pair into fanning strips as they are tested out.

This test, while slow in changing the battery on

Fig. 2. Testing Device.

each pair, is extremely simple and thoroughly practical, if the cable is tested for opens, crosses and grounds previous to making the test. If trouble is found on the preliminary test, that pair should be left out when "bunching" on the frame and left until the last. The odd pair will be the one which is in trouble and can be placed in its proper position in the fanning strip when found.

The Chicago Telephone Company passed the coveted quarter-million mark not long ago, its present total of subscribers being well over 250,000.

Underground Use of the Telephone

From near Joplin, Mo., where the young son of a coal mine operator was entombed in a mine several days by a cave-in of a shaft, is presented dramatically a triumph for the modern telephone.

While Joseph Cleary, the mine owner's son, and two workmen were ninety feet underground a sudden crumbling in of the earth entombed them. The workmen got out of the shaft, but young Cleary was cut off by tons of debris.

Frantically the mine owner set to work drilling through the earth in an effort to supply air to his son, while the work of digging out the shaft went on. So terrible was the boy's fate believed to be that his mother in her home was completely prostrated. Brothers, father and other relatives and workmen drilled hour after hour to punch an air hole through the earth to the buried boy. Finally, on Tuesday morning, the drill broke through into the shaft, and frantic relatives shouted down the hole.

Faintly from the shaft far below the surface came an answering cry. Brother shouted to brother for assurance that the entombed boy yet lived, and then the father himself had to hear the subterranean whisper to be assured.

The entombed boy was all right, but terribly hungry. His first want was for something to eat, not a remarkable fact, considering his long fast.

This was a practical and immediate need, because he was faint, yet his greatest wish was to talk to his mother, who was prostrated and grieving at her home, too sick to come to the opening of the shaft and shout down into the dark fastnesses of the earth, as did the stronger relatives.

Here enters the modern inventions of the age. Immediately upon learning of his situation, the Home Telephone Company lowered down to the entombed boy, through the hole in which food and drink had been sent 90 feet into the earth, a modern telephone. It was but the work of a few minutes, and the mother, prostrated in her own bed at home, heard from her boy entombed under 90 feet of earth, the great news told in his own assuring way that he was yet alive.

Thanks to the same useful invention, after he had consoled his mother, the entombed boy called up a newspaper office, and himself reported the progress of his rescue in order that hundreds of thousands of readers, curious as to his fate, might know of his strange adventure. By means of the telephone and the modern printing presses and the telegraph news agencies the whole world knew almost as soon as did the frantic relatives on the ground above him, just how it seemed to be buried alive by such accident.

What would we do these days without the telephone?

Telephone Pioneers of America to Meet

The first meeting of the Telephone Pioneers of America has been called to be held at Boston, Mass., Thursday, Friday and Saturday, November 2, 3 and 4.

President Theodore N. Vail and Prof. Alexander Graham Bell have signified their intention to be present and it is believed there will be a large attendance from all parts of the country.

It was practically the unanimous vote of the Pioneers to meet in Boston in view of its being the birthplace of the practical telephone.

Arrangements as to entertainment and meeting will be announced later.

Who's Who in the Telephone Game

Facts and Fancies About a Man You Know or Ought to Know

THERE are very few telephone engineers who have time for diversions, because a really for sure telephone engineer never runs the risk of having his mind grow dull and torpid. The telephone business provides peculiar divertisements to keep the mind actively engaged in continuous twenty-four-hour shifts. Men whose minds must be treated to a wade in the swamps for snipe, or into the Sunday supplements for chess problems, are never seriously fitted for the bigger effort of keeping ahead of a metropolitan telephone exchange.

Sherwood Johnston Larned has been leading an unruly telephone system by the ring in its nose for twenty-one years. He doesn't trust it for a minute. With one eye on the critter and the other on sure ground ahead, with both hands he hangs onto the rope. And he *larned* how to do this trick out of the books of Cornell—larned the Larned method in theory and has worn the rough edges down to a smooth finish by many a long year's practice.

He's There, Because He's There with the Goods.

Young Sherwood Larned graduated from a full course in the department of electrical engineering at Cornell University in the spring of 1890 and immediately entered the service of the American Telephone and Telegraph Company at New York as a telephone engineer. For two years he exercised his ability and cleverness without restraint, having to do with inspection, testing, experimenting and development. For telephone engineers were scarce in 1890 and things for telephone engineers to do were not. The experimental department of the A. T. & T. is always the busiest place on earth, but in the early nineties it was more so. Inspection and testing of cables and subscribers' instruments has developed into one of the fine arts as a result of those early days when Larned was doing overtime in New York. And if you go back twenty-one years in the record of long distance work, you will find some mighty interesting data with "S. J. L." initialed on the line marked "approved." In passing, if there is merit in honest work, these old records should be remembered now and then, for there is more to Mr. Larned's success than his ability to keep ahead of a big corporation. The nice, smooth surface of his flat-topped mahogany desk doesn't imply that he is there to add a pleasing aspect to the scenery. He's there, because he's there with the goods. His record has other initials on the approved line—his superiors begrudge him nothing. Then, too, men of the Larned type have made possible the thoroughness of the world's largest corporation—the greatest public serving institution of modern progress. Larned is responsible to the limit of his zone of operation and there is no questioning his powers, his efficiency or his method. When his report is ready, it is ready and it has a welcome.

In 1892 Mr. Larned come to Chicago to assist in the organization of an engineering department for the Chicago Telephone Company. He had the title of Acting Chief Engineer, but the title wasn't so important or necessary as the work at hand. The system was grounded line, 8,000 installed. The long-distance connection between New York and Chicago was nearing completion and the whole plan contemplated metallic circuit service; automatic line signaling; multiple switchboards. During those strenuous years Mr. Larned was engaged in designing and installing for the newer order of things.

In 1896 Mr. Larned was given the title of Superintendent in charge of traffic and maintenance departments, and in 1900 he received the appointment of General Superintendent, having direct charge of traffic and plant. Either one of these departments offers more than a whole job for the average man. During his incumbency of the general superintendency, the Chicago Telephone Company developed a system from about 8,000 stations to more than a quarter million subscribers. The traffic requirements of serving this enormous total—the plant requirement of providing for such rapid and stupendous growth, called for activity seldom found in one individual. The Chicago Telephone Company handles approximately a million and three-quarter telephone calls a day, requiring the services of 8,000 employees.

Given a job is one thing, but to hold the kind of a job that was given to Sherwood Larned in 1896 is quite another thing. It is no exaggeration to say that this demure and unassuming telephone engineer has had a broader and more active experience than many of his brothers. That he has developed with the job goes with-

out argument. Sherwood Johnston Larned is forty-four years young, but he doesn't look it. He has a few gray hairs, but he must have got them from Angus S. Hibbard, who has 'em to spare. He is scarcely above medium height, compactly built. His shoulders make no apology for his hard service, for they are square and straight.

Mr. Larned lives in the vicinity of the Chicago University and his friends and neighbors include a host of the faculty of that institution. His agreeable companionship is vouchsafed by fellow members of his clubs—the University, the Literary, and Homewood. He is a member of his neighborhood association, which is operated in connection with the University Settlement, which lists him as a director. His most intimate friends accuse him of being a nature faker. The discovery was made by leaning over his garden fence where this city-bred and born victim was trying to make three flowers blow where only one would bloom before. Every man has his weakness, and Larned finds his great pleasure down in the dirt with the daisies.

His very newest job is so big that imagination doesn't help in its contemplation. Mr. S. J. Larned is designated general traffic superintendent of the Bell's Central Group, comprising 860,420 regular blue Bell stations; 613,982 interconnected or independent telephones, or a total of 1,474,402!

So if you can't get through; if central has a "tin-ear"; if that rubber-neck on your line doesn't behave—any one of you million and a half trouble-makers—call Main 294 and ask for Mr. Larned. He will fix you out in his best Sunday manner, which he works seven days and seven nights every week.

American Automatic Telephones Abroad

Consul General John P. Bray, Sydney, Australia, says: There has been formed in that city the Automatic Telephones (Australasia) Ltd., with a capital of £250,000 ($1,215,000) for the purchase of the agency of the Automatic Electric Company, of Chicago, in the territory of Australia and New Zealand. Included in the agreement is an option of purchasing, at certain fixed prices and royalties, during the first two years of the agency agreement, the American concern's manufacturing and selling rights in Australasia, also an option of purchasing the necessary machinery and plant (exclusive of power) f. o. b. Chicago, for the local manufacture of telephones, guaranteed equal to an output of 10,000 automatic equipments per annum.

This flotation is the outgrowth of a demonstration made by the Chicago company of an experimental installation in the Sydney post office, under which department of government telephone administration is controlled. The same system obtains in New Zealand, and the company, therefore, can not sell telephones to the public without government sanction; that is, with assured connections with the trunk lines. The federal government, however, is now calling for tenders for automatic telephone equipment for Geelong in the state of Victoria, and it is there that the first general application of the automatic telephone will be made.

In the United Kingdom, as a result of visits recently paid to America by the engineer in chief and other headquarters officers of the post office, the postmaster general has decided to introduce experimentally into this country some of the systems of automatic telephone exchange working which are now installed in several cities of the United States.

Three or four different systems are in use in America, and these have all been investigated both in their electrical and economic aspects in that country. The automatic system represents a radical departure from the existing general method of exchange working, and it is felt that in order to keep abreast of telephone progress the time has arrived for giving these systems a practical trial in Great Britain. The mechanical and electrical problems involved have now to a great extent been satisfactorily solved, and it remains to be decided whether such systems will be economical, and, further, whether they will be popular with the British public.

Negotiations are now in hand for the installation of an automatic exchange on the Strowger principle at Epsom and for another on the Lorimer system at Caterham. Each of these exchanges will be equipped with about 500 lines at the outset, and will probably be installed within the next six or eight months. The exchange serving the official departments at St. Martin's le Grand is also to be converted to the automatic system, and, will include about 400 lines.

The development of semiautomatic exchanges is also being closely watched. These exchanges utilize the ordinary type of subscriber's telephone, as used on the existing common battery manual exchange system, and the method of working is identical so far as the subscribers are concerned. The installation of a trial exchange of the semiautomatic type would merely test the efficiency of the exchange apparatus and would give no information as to whether the public is prepared to accept and successfully operate the full automatic system of working. The experimental equipments about to be installed are expected to yield all the information necessary to determine the future policy of the department.

In these equipments, after the subscriber has automatically secured the subscriber to whom he wishes to speak, the line is automatically cleared after the conversation is finished; all apparatus is restored to the normal working condition by the replacing of the receiver on the hook. A subscriber's instrument on an automatic telephone system is fitted with a movable disk containing 10 finger holes; these holes are numbered from 0 to 9, and any number is made up by inserting the finger in the holes that go to make up the number wanted and pulling the disk round each time until it reaches a stop, when it returns to the original position. Junction work is practically eliminated. The ringing of the called subscriber is automatic. Calls are metered or registered, and arrangements are made for unregistered calls when talking to officials, etc.

Most of the telephone manufacturers are now busy developing automatic systems, but it is claimed on behalf of the Strowger system that there are 300,000 telephones working upon it, San Francisco, Oakland, Los Angeles, Columbus, Grand Rapids, and Chicago being among the largest installations. San Francisco and Los Angeles are both laid out on the basis of 100,000 lines. The Chicago system, just being brought into use, is to be suitable for 1,000,000 lines. About seven years ago one of the first automatic telephone exchanges ever built was erected at Albuquerque, N. M. This had a capacity of about 200 lines, has been giving entire satisfaction, and is still a financial success.

Digest of Foreign Telephone Literature

Translated for Our Readers

A NEW ALTERNATING CURRENT GENERATOR FOR TELEPHONE PRACTICE.

TO MAKE telephone service easier and to lessen the time necessary for making connections, smaller German telephone exchanges use a new alternating ringing current generator instead of the old style magnet inductors. These consisted in the main of a pole changer, a transformer and a condenser. The new generator shown in the figure is called the "pendulum transformer" and is a very simple direct current generator, using very little energy. This instrument is large enough for a small exchange up to 500 subscribers. In this transformer no electromagnets with automatic breaking contact are used, although these are usually necessary in the pendulum style of transformer to move the pendulum. The condensers are also omitted, which is a very unusual thing in this type of apparatus. The operating magnets are omitted, as said before, and in their stead the double pole, equally polarized armature of the pendulum has been placed in a weak artificially created magnetic field (leakage field) of the transformer, which serves to set the pendulum in motion. The wiring arrangement is seen in the figure, and needs no further explanation. The condensers are dispensed with, and the apparatus works in the following way: Before cutting out one-half of the spool or coil, the other half is thrown in parallel to the first half for a very short length of time by means of a contact piece attached to the pendulum. The result is the induction of a current of equal tension but opposite direction in the latter coil, which has the same number of windings but in an opposite direction of the first coil. The primary current is lowered for a moment to the zero point, so that during this time there is an absolutely sparkless action in cutting out the previously thrown-in coil. An ammeter is used to regulate the time for the parallel arrangement accurately, this instrument being shunted in the primary circuit. There are several regulating screws, and turning these sets the time, the ammeter showing when the correct position is assumed by indicating the lowest value.

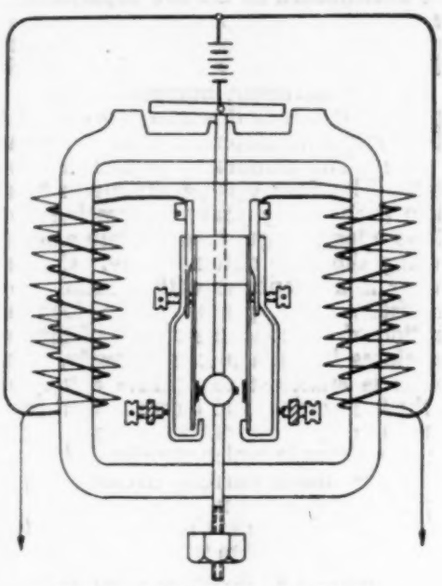


Diagram of the Pendulum Pole Changer.

Extensive tests were made at the German testing station with this generator for 12 volt when operating 10 a. c. signal bells. The results showed very clearly the absence of harmonious vibrations in the pendulum, which would be liable to occur when using condensers, due to the natural vibrations of the same. The frequencies for the different transformers are set at 17, 30, 43 and 56 seconds, which is quite a contrast to the usual 1,000 to 4,000 per minute arrangement, which has to be used to allow for the rotating machines. This precludes the occurrence of resonance in the numbers of periods, which would result in two alarm bells ringing at the same time. The accuracy of the transformers is so great that one alarm can be arranged for each six periods difference. These pendulum transformers are made from 4 to 110 volts wound with series resistance to 220 volts. Where exchanges of over 500 subscribers use these instruments a set of four or more is used, for connection to 12 to 220 volts d. c. As the energy consumption of these instruments due to the omission of pendulum magnets is very low, they can be made for the very low primary voltage of 2 to 6 watts without load, so that storage batteries can be used as a current source. The absolutely safe and rapid working of these transformers permits the connection of a primary current circuit only at the moment when the alternating current is needed, so that the alternating current generation is considerably increased, since the current used for no-load running is very low.—*Elektrotechnische Zeitschrift.*

SOME NEW INSTRUMENTS AT THE MUNICH EXHIBITION.

The Munich electrical exhibition brought to light some new applications of low voltage electric current and telephone apparatus, of which the most interesting are here described.

The Mix and Genet Company of Berlin exhibited a new telewriter apparatus, based on the principle of Cowper and Gray to cause a change of resistance and current direction by the movement of a pointer whose influence on a galvanometer leads to the repetition of the same movements at the receiving station.

The sending station, from which the written messages are transmitted, has a sender and the second station, where the messages are received, has a receiving instrument. Both instruments are connected by three of five wires. If a message is to be sent from station one to two, the sender presses a button on the transmitting instrument, whereupon a buzzer is heard. Then he takes a pencil connected with the sending instrument and writes on a small paper about 8 by 10 inches, the pressure of the pencil point against a small switch closing the circuit for communication. At the same moment the receiver at station two writes

the characters sent by one with ink on a paper surface of equal area. As a control for the assurance that both instruments work, a signal lamp lights up on the transmitting instrument as long as the apparatus is in operation. The paper for writing is fastened on rollers, and the pressure of the pencil on a small switch moves the roller, so that a new paper surface is always exposed to the action of the pencil. As soon as communications are written down, a second pressure of the pencil upon a similar switch suffices to set both instruments out of operation. If messages are to be exchanged between two stations, both of them have a sender and receiver, so that each aggregate forms a complete station.

Constant direct current at 36, 110 or 220 volts is necessary for the operation of the instrument. In opposition to the long distance telegraph and the telewriter, no previous knowledge is needed to work this instrument, as only writing movements are employed. The speed of transmission is equal to that of the telephone with the additional advantage that, sketches, drawings and letters as also manuscripts can be transmitted. Since each one of the communications sent is exactly copied at the receiving station, these messages have a legal value and are binding, an added advantage over the telephone message. Moreover, since the instrument works automatically, the presence of an operator at the receiving station is superfluous. The apparatus works noiselessly, and can be used in factory buildings where the great noise would make the telephone useless. The same messages can be sent to several places at the same time, and tests have shown that messages were correctly transmitted to as high a number as 25 stations at one time. This same instrument works in combination with the telephone if necessary, so that messages can be sent verbatim and confirmed by writing at the same time. Tests have proved the apparatus to be able to transmit even the fastest written messages correctly, and a breaking in on wires, as is possible in the telephone, is out of the question. It is also possible to select a certain station from a number of stations, the arrangement being similar to a switch system on the ordinary telephone. The adaption to various industries is plain enough, and while the telewriter will never replace the telephone entirely it will be a great improvement over the same in many respects.

Another novelty is a dictating phonograph which permits the dictating of letters to the typewriter over as long a distance as 3,000 feet. The dictating person uses one of the usual desk telephone instruments, equipped, however, with a very sensitive stentor microphone. The typewriter has a loud-speaking telephone, composed of a telephone of the stentor type and a controlling microphone on her desk, so that she can answer to questions without lifting the instrument. The sound of voices can be transmitted through the transmitter in a loud tone, so that in a quiet room the voice can be understood at a distance of 45 feet. For return questions the typewriter uses a very sensitive controlling microphone which receives sounds at a distance of 45 feet from the same and sends them to the receiver at the other end of the line, where they can be plainly understood.—*Zeit. f. Schwachstromtechnik.*

TELEPHONE SERVICE IN THE FIRE DEPARTMENT.

A test is being made in Kiel to do away with the telegraph for fire alarm service and to substitute the loud speaking telephone for the same. One of the drawbacks to this is the fact that mistakes are liable to happen in transmitting fire alarms, while an advantage is, that the engines can be accurately directed to the house on fire, where in the telegraph alarm only the district and alarm box position is given, leading to a loss of time on part of the fire engines in finding the fire. An added advantage is the fact that the loud speaking telephone gives notice to the fire department as to the extent and magnitude of the fire. Where a fire lies in a district covered by several engine houses, and where one engine has gone to fight the fire, the man giving the alarm can be told that the fire is attended to and thus the useless calling out of engines is avoided. This fact is of special importance in smaller towns, where the withdrawal of fire engines to one fire means that other sections of the town are without protection. As a matter of fact, statistics show that a large percentage of fire alarms in larger towns is received over the telephone. Moreover only experienced men are used to operate the fire alarm telephone switchboard at the fire department, so that with the aid of the loud speaking telephone, mistakes seem out of the reach of possibility. The system used in Kiel is the following: Cast iron boxes, marked with the fire alarm department number, are used to hold the telephone. Inside of this iron case are an air tight closed box and a microphone with changeable diaphragm case. The diaphragm is protected by a fine wire mesh. The door closing the alarm box is constructed in such a way that the pressing down of a lever allows a long tongue to glide into a slanting slit, thus opening the door automatically. On the inside of this door is a telephone with a small mouthpiece for transmitter. The opening of the door interrupts for a fraction of a second the circuit of the fire alarm wire and closes it again instantaneously. This short interruption is sufficient to operate a very sensitive relay at the fire station, and closes a local current circuit. The door is also arranged so that it cannot remain in the position in which the circuit is broken. In addition to the alarm current circuit a signal lamp lights up at the same time. There is no difficulty either, if necessary, in operating the alarm signals and lighting up the alarm lights in all of the engine houses at the same time. The receiving relay is mounted on a special switchboard, on which are also the following instruments: An ordinary telephone instrument and a transformer which is to transform the microphone current generated by the telephone, so that the telephone at the fire station will allow free and unhindered communication. A storage battery of twelve cells gives the necessary current for the telephone. The alarm box at present rings the signal at the engine house, operated by the opening of the door; but arrangement has been made to equip the same with an inductor, if necessary.—*Elektrotechnische Zeitschrift.*

DIAPHRAGM TO PREVENT THE CLICKING IN RECEIVERS.

One of the most disagreeable things in telephone practice, which, however, receives the least attention, is the clicking noise in receivers due to the powerful discharges in the condensers, transmitted to the diaphragm of the receiver and to the ear. Anyone using the telephone habitually, as is the case with telephone operators both at exchanges and at private switchboards, knows how such a sharp noise hurts the ear when the receiver is as close to the ear as is the case in the exchanges. The charge of the author, Herr Bähr, that this habitual noise can cause ear diseases

and partial deafness may be worth the trouble of investigation.

The receiver diaphragm still consists of the same material used by the inventor, A. Graham Bell, namely soft iron. It meets the demand placed upon it, to transform electric into acoustic vibrations. But the development of long distance telephone practice has brought forth the fact that these diaphragms respond to alternating current as also to the closing and opening of direct current circuits by a sharp clicking noise. The author made extensive experiments with these diaphragms, and followed two lines of investigations, namely one magnetic and one acoustic method. The magnetic problem falls to the lot of the middle part of the diaphragm just above the pole piece, since only that portion serves as armature for the magnet, which is cut by the latter's magnetic lines. The usual diaphragm is about 56 mm. diameter, and the small central ring of about 6 mm. radius is used as armature, and is made of some magnetic material like iron, cobalt, nickel or certain nickel alloys.

To meet the second problem, the material must be elastic. It seems possible to get a useful diaphragm by making the part which, so to speak, serves to bear or carry the armature, of some other elastic material and not of iron. Tests in that direction did not, however, show that the clicking noise was eliminated, and the author devoted his time to lower this clicking noise down to a minimum.

The clicking noise can only come from the iron, since the entire diaphragm is made of that material. It was thought first that the clicking noise was due to the snapping back of the membrane upon the pole pieces. But this is probably not the case. However, the plan was to substitute for the central portion, usually of iron, some other material like aluminum, tin, zinc, copper, brass, mica, ivory, wood, hard rubber, etc. The form of this part is best made circular, but square pieces have been tried with success, and this portion was even made of woven wire mesh, making the armature of iron filings. The armature can be connected with its support either by pressing it firmly down upon the same, welding it there, gluing, or using any other similar means. In looking for a substitute for iron, the metals usually used for acoustic effects, like tin, copper, bell metal and brass were found to be applicable. Brass was found to give the best results, as it can be obtained in very thin sheets and can be varied in composition so as to give only a very faint clicking noise. The writer then tried wood, which is used for resonance buttons in violins and other musical instruments. Its low specific gravity of 0.3 as against 7.88 for iron gives additional advantage to the same, and trials have given very successful wooden diaphragms. Glass of 0.5 mm. thickness was also tried with success. Hard rubber was also tried, but this material is too elastic and the sound is not transmitted clear and sharp. In investigating the various forms of diaphragm, the author started from the supposition that the circular disc made of non-magnetic material was attracted and pulled along by the other iron disc, attached to the former, when the same is attracted or repelled by the opposite pole pieces. The result was, in fact, a vibration of the entire diaphragm. But an even better result was reached when the center of the neutral material was made with a circular opening of about 6.5 mm. radius, and when this was covered with the iron disc. With this arrangement, the latter could vibrate freely, and still force its supports into sympathetic vibrations. As the ordinary switchboard head receivers were not powerful enough, the writer tried to construct a new receiver, keeping the weight of the magnetic material low, and increasing the magnetic qualities by some other means, and at the same time keeping the advantages of the single pole receivers in their clearness of sound transmission. The first receiver constructed by Bell was a single pole receiver, and the advantage of very clear transmission of sound has always been claimed for this. Later, however, the two pole receiver supplanted the single pole instrument, but lost its great value when the microphone was introduced to serve as transmitter and put an end to the practice of using the two pole receiver as transmitter. The advantages of the single pole receiver made the author construct his new receiver, using the principle of the d'Arsonval instrument, especially as regards the construction of the magnet. The magnet consists of two steel discs of 1.8 mm. thickness, resting on like poles, facing each other. The one pole piece is at the center of the entire system, and is screwed to the lower side of the N-pole, and protrudes through the coil spool and ends opposite the central piece of the diaphragm. The other pole piece is set upon the S-pole and surrounds the upper half of the coil-spool, in form of a mantle, slit in the center from top to bottom. It influences this spool from the outside and helps at the same time to close the magnetic circuit as closely as possible. The bulk of the magnet takes about 3.9 ccm. space with an area of 5,000 sq. mm. weight being 35 grams. The listening coil has 1000 windings and 60 ohm resistance; the total weight of the instrument is 200 grams, and it gives perfect results. The regulating arrangement which enables the operator to use the same receiver for short and long distance work and to lessen the clicking noise in the iron diaphragm by increasing the distance between the diaphragm and pole pieces is unnecessary in this receiver. Moreover, as a rule there is no need for such an arrangement, for the general public does not know about this, or does not take the time to regulate the receiver, and in local exchanges the distances are not great enough to necessitate such a device. In addition it has been the experience of the author that exchange operators make wrong use of this device in order to lessen the clicking noise in their receivers. They increase the distance between pole pieces and diaphragm as much as possible, and then press the receiver as close to the ear as possible and listen to messages with strained ear in order to understand the same, for naturally with the clicking noise, the clearness and loudness of transmitted sound is also lowered. The new heterogeneous diaphragm receiver eliminates all this trouble, and being always in condition for efficient service without the disagreeable and harmful clicking, has found favor in German telephone exchanges, and meets the required conditions for good service and increased welfare of the operating staff.—*Zeit. f. Schwachstromtechnik.*

Duluth and Iron Range Adopts Telephone

The telephone is to replace the telegraph for train dispatching on the Duluth & Iron Range Railroad. A circuit is now being installed between Two Harbors and Ely, with a branch from Allen Junction to Virginia and Eveleth, in Minnesota. The new dispatching system will cover 123 miles, and there will be fifteen way stations. The dispatcher will be located at Two Harbors.

International Congress of Electricity at Turin

An International Congress of the Applications of Electricity will be held at Turin, Italy, September 9 to 20, 1911, under the auspices of the Italian Electrotechnical Association and the Italian Electrotechnical Committee, during the period of the International Exhibition of Industry and Labor.

Besides the papers offered by the official reporters, the Committee of Organization will consider papers or proposals presented by members or by any electrical association. Before the opening of the congress the Committee of Organization will endeavor to print the papers offered, provided that such papers are received before June 30. Papers may be written in French, or in English, German or Italian accompanied by a translation or a summary in French, and these languages will be admitted in the discussions.

Papers will appear in the transactions of the congress in their original language, those in English, German and Italian being accompanied by a French translation or summary.

The subjects for discussion are:

1. Electrical and mechanical characteristics of modern electric generators, with special reference to high-speed machines.
2. Present state of technical progress in the manufacture of stationary and traction batteries.
3. Simultaneous running of several generating plants, all feeding the same system of network.
4. Selection of the transmission and distributing pressure and the design of switchboards and substations in large electrical installations, taking into account both economy in first cost and continuity of service.
5. Underground high-tension networks in metallic connection with overhead lines.
6. Present state of research in reference to abnormal rises in pressure and means of their prevention and protection of the system.
7. Construction and use of automatic circuit-breakers.
8. Methods of cooling transformers of moderate power.
9. Converters, rectifiers and motor-generators.
10. The problem of frequency transformation.
11. Technical and economic influence on the lighting industry of the new metallic-filament lamp and of the metallized-carbon lamp.
12. Three-phase variable-speed motors, with special reference to rolling mills and paper mills.
13. Monophase traction *versus* three-phase traction on main lines.
14. High-tension continuous-current traction *versus* monophase traction on suburban lines.
15. Overhead line construction for electric railways.
16. Direct production of steel from ores by means of the electric furnace.
17. Sterilization of water by processes employing electricity.
18. Electricity meters, with special reference to different kinds of loads.
19. Government control of meters.
20. Rational methods of commercial measurment of electric power.
21. The problem of increasing the load-factor in central stations.
22. Application of electricity to submarine boats.
23. Long-distance wire telephony.
24. Wireless telephony.
25. Automatic telephone exchanges as a means of economy and improvement in telephonic communication in large cities.
26. Research on secrecy in wireless telegraph.
27. Present and future development of electric heating.
28. Comparative study of the direct and indirect methods of taxing electricity in different countries.
29. Government regulations in reference to the electric transmission of power.
30. Distribution of electric power for agricultural purposes.
31. Various systems of multiplex telegraphy.

The New Bell Central Group

Under the new organization of the Central Group of Bell Telephone Companies, the Chicago Telephone Company, the Central Union Telephone Company, the Wisconsin Telephone Company, the Cleveland Telephone Company and the Michigan State Telephone Company become practically one operating unit with headquarters in Chicago.

The territory occupied by the five companies comprises the states of Michigan, Wisconsin, Ohio, Indiana and Illinois, with the exception of a few counties.

The organization is the second largest telephone operating unit in the world. The number of telephones operated, including those connecting companies, on July 1, was 1,474,402. The population of the territory is about 18,500,000 and its area 250,000 square miles.

The purposes of the formation of the group are stated in general bulletin number one, issued from the Chicago headquarters May 24. It says:

> For convenience in operating and the greater benefits to be derived thereby for both the public and the companies the five telephone properties are being grouped into one operating unit with headquarters at Chicago, where one set of general officers will manage the business instead of five sets, as heretofore.
>
> The general officers of the new operating unit ask the same loyal co-operation that has heretofore been given by all employees in the several companies. This broadening of the organization affords greater opportunities for advancement in all departments. Good service, courteous treatment of the public and the intelligent discharge of our several duties will extend the usefulness of the telephone and make the Bell System universal.

A twenty story office building is now in course of erection at Franklin and Washington streets, Chicago, for the headquarters of the group of companies. The building will cost $1,600,000, while present plans contemplate the razing of the present main building and carrying the twenty-story structure over the entire site.

Wisconsin Commission Notes

The Wisconsin Commission has been making an extensive investigation of the telephone service at Madison, and reports an inadequate equipment. The company claims a more rapid development in that city than it had anticipated.

The commission has had its powers greatly increased by the legislature, and now is in practical control of all public utility stock and bond issues.

The commission did not grant the appeal of the Wisconsin Telephone Company for relief from the necessity of burying its wires in certain streets of La Crosse, as ordered by the city council.

Inspection of Telephone Wire

By Hugh T. Wreaks*

THE operation of a telephone system involves, from the mechanical or engineering side, the use of a large variety and number of appliances, apparatus and material, all of these being grouped so as to form a large number of complex and interwoven circuits for the purpose of transmitting signals, both physical and vocal, by means of electric current.

I think it may be safely stated that each of these circuits is composed of more than ninety per cent of wire of one kind or another; and, therefore, that the efficiency of any telephone system and, to this extent, its success, depends very largely on the reliability of the wire used and how well this wire confines and protects the telephonic electric current passing over it.

There are several kinds and qualities of wire and cable used; those that I am familiar with being as follows:

1. Telephone cord.
2. Twisted-pair inside wire.
3. Twisted-pair bridle wire.
4. Pothead wire.

Nos. 1, 2, 3, and 4 are all soft-drawn copper.

5. Twisted-pair outside wire.
6. Bare copper wire.
7. Weatherproof wire.

Nos. 5, 6, and 7 are all hard-drawn copper.

8. Copper-steel wire.
9. Weatherproof copper-steel wire.
10. Galvanized-iron wire.
11. Lead-covered paper cables.
12. Aerial cables, rubber-covered copper wire.

All of these wires, when bought by the American Telephone & Telegraph Company, Western Union Telegraph Company, United States Government and, presumably, when bought by various members of this association, are covered by specifications which go quite into detail as to various characteristics, tests and requirements to which these wires shall conform. These tests and requirements are passed upon, as a rule, at factories where the wire is made up, and almost invariably cause the rejection of a certain number of coils of such wire, which latter are knows as culls. These culls frequently go to such purchasers as do not have their wire inspected.

These tests are sometimes quite complicated and require an appreciable quantity of reliable and expensive apparatus and equipment. Though not infallible, if properly made they are a valuable guide to purchasers of wire. It might not be amiss to enumerate some of these tests and explain what they mean and how they can be interpreted. For convenience, I will group these tests as follows:

Tests on braid.
Tests on rubber insulation—ordinary grade.
Tests on rubber insulation—high grade.
Tests on copper wire—soft drawn.
Tests on copper wire—hard drawn.
Tests on tinning.
Tests on copper-steel wire.
Tests on galvanized-iron wire.
Tests on lead-covered paper cables.

*Abstract of paper read at the fourteenth annual convention of the National Independent Telephone Association.

Qualities of Braided Coverings.—The braided covering on a wire serves two functions, which are not always appreciated. It adds strength to the wire, and should serve as a protector for and prevent action of air on the compound or conductors underneath.

This means that when the braid is exposed to the atmosphere it should withstand temperatures varying from, say 130 degrees to zero, Fahrenheit, without any deleterious effect on the braid itself or the preservative and air-excluding compound with which it is saturated. The braid should be so saturated with a waxy or filling compound as to absorb but little moisture. Any braid which continuously absorbs appreciable moisture and then dries out will rot in a relatively short time. The braid should be strong and flexible enough to protect the conductor during ordinary process of handling, and if strong enough not to be injured in handling, it is likely to give a good account of itself in service. Unfortunately, the qualities here mentioned are not all consistent with one another. That is to say, those waxes which best exclude water may tend to stiffen the wire and crack the braid when bent or if put into the braid at a temperature high enough to thoroughly saturate it, they may slightly char the braid fiber. Again, the waxes which best withstand high temperatures will not best withstand low temperatures, although of the two the former is, I believe, generally considered the most important. To cover these points properly requires specifications which strike a mean.

No great amount of apparatus is required to make tests on braid, the high temperature being developed by a water-jacket oven, and the low temperature by a freezing mixture. The moisture-absorbing qualities are tested by carefully weighing selected samples on a good chemical balance before and after a twenty-four-hour immersion in water, and the strength and flexibility of the braid are determined by a combination of bending and straining tests, together with comparison of the number of yarn ends and ply and size of cotton used in the braid.

The rubber insulation, both low and high grade, has been in the past and is even now, to a less extent, a bone of severe contention between purchasing agents and wire manufacturers. That is to say, it is found difficult to so specify that the manufacturer of a good compound will be protected against the competition of a poor compound. Yet much can be accomplished, even here, by proper specifications.

The Insulating Compound.—The characteristics of a good compound are high insulating qualities; long life, both physical and electrical; and sufficient strength to withstand, without damage, such handling as it will receive when being installed. The quality of strength is not so important here, especially when the insulation is covered by a braid, as the latter, if good, gives to the wire its requisite strength. There are, however, many engineers who claim that a relation exists between the electrical, physical and aging qualities of a rubber insulation, but we have made a great many experiments without discovering such relation.

As to tests, the apparatus for electrical tests on rubber insulation is quite expensive and cumbersome.

First, it is necessary to install large water tanks, together with necessary cranes and other apparatus for handling the coils and putting them in and removing them from the water, as all these electrical tests on rubber compounds are made on coils immersed in water. Transformers of ample capacity and capable of giving at least 3,000 volts and preferably 10,000 volts are needed, together with switchboards and other apparatus for the purpose of applying the necessary voltages so as to locate the weak spots, which either show up immediately or are observed when the insulation resistance is taken. The insulation-resistance test requires a sensitive galvanometer, so mounted as to be free from vibration, together with the necessary scale, telescope, shunt, high resistance and batteries.

Three Tests for Compound.—The physical tests on ordinary-grade insulation may be classified under three heads: hardness, flexibility and softness. The test for hardness requires no apparatus except a sharp knife and a little practice, and consists in carefully removing the braid and then wrapping the insulation on itself and seeing that no crack develop in less than twenty-four hours. The test for flexibility consists in wrapping the insulated and braided wire, under tension, around a small mandrel immersed in water, and measuring by electrical tests the damage, if any, that has been done.

The tests for softness are made directly on the insulation and, by means of an electrical circuit and a scale, tell how many pounds pressure it takes for a given tool edge to cut through the insulation.

The physical tests on high-grade insulation are generally in the nature of a stretch and return test, say, from two inches to six inches and return in one minute to two and one-fourth inches, then the stretch without breaking to nine inches. They also call for a breaking strain of, say, 800 pounds per square inch.

Also, the specifications for high-grade rubber insulation generally call for chemical tests, these being in the nature of identification tests. These also serve a useful purpose, but, at times, from their delicate and intricate nature, are liable to be misleading. As yet, no chemical tests of value have been developed for ordinary-grade rubber compounds.

How Copper is Tested.—The tests for both soft and hard-drawn copper are, in the main, alike in kind but very different in degree. The elongation test and breaking-strength test are called for, for both, and a twisting test is called for for soft copper. The hard copper, again, must be carefully observed for splinters, as, although these are not serious from an electrical point of view, they are very dangerous to the linemen who handle the wire.

In making tests for strength and elongation, a tensile machine is required which, for hard-drawn wire, has to register quite high breaking strains.

The twisting test on soft-drawn wire, except on large sizes, needs only a simple apparatus. Conductivity tests are also specified for both soft and hard-drawn wire, although for the former they are of less importance, as practically all copper when soft has a conductivity above specifications. When hardened during annealing, baser metals may be used which would appreciably lower the conductivity.

The resistance of the copper is, of course, important and is included in conductivity measurements, the two together helping to check up the lengths of the coils and the amount of a given order.

Of course the quantity of copper cannot be determined without a knowledge of its cross sections and measurements with micrometer calipers. These measurements are also essential to properly check up insulation and braids.

Why Copper Wire is Tinned.—The tinning of wire is put on in order to preserve the copper, presumably against any action from free sulphur or oxidizing agents in the rubber compound, and also to protect the copper from the air in case the braid and compound on the wire are damaged in spots. This latter occurrence is, however, not anticipated and will require a tinning much heavier than is generally used. The tinning of copper wire is not as simple an operation as would at first appear, as the tin must be put on before the wire is insulated and must, therefore, form a flexible coating and not one likely to be damaged in the handling before insulating and in this process itself. Obviously, too thick a coating of tin would be likely to chip off in this handling. The tests on tinning are, first, a chemical test which, by means of alternate immersions in solutions of hydrochloric acid and sodium sulphide of stated strength and for stated periods and times, tells in effect the amount of tin on the wire. Should this test, however, be made too severe, it might compel so thick a coating that the latter would crack when the wire is bent. Another test specified is to bend the wire around a given mandrel dependent on size of wire and then immerse it in a sodium solution for stated intervals. Both these tests must be made with care, as otherwise the exposed copper ends of tested samples will affect the test, and possibly the solution. These tests are empirical in their nature and are what might be called factor-of-safety tests, being made under severer conditions than are generally met in practice. Again, since we have been making inspections and tests on wire, we have heard much of corrosion of copper in insulated wires, due to oxidizing agents, etc., in the insulation; these acting direct on the copper on account of defective tinning. But our experience to date with field samples fails to show any action of this kind which is clearly due to such causes, or what might be called internal causes. At the same time, all tinned wire can to advantage be inspected before insulation, to show that tin was properly applied and the copper wire is free from splices and sufficiently smooth to permit of good tinning.

Every sample of wire which we have yet seen in which the copper was corroded also showed the rubber and braid badly decayed or dried out and, conversely, where the braid and its saturation appeared still good, the insulation, tinning and copper seemed O. K. This evidence is, however, negative rather than positive, but would indicate that the tinning is generally well put on.

Tests on Copper-Clad Wire.—Copper-steel, or, as it is sometimes called, copper-clad wire, is a relatively new product commercially and, therefore, as yet not so much is known about how it develops with age, and the specifications under which it is bought are more nearly a manufacturers' than a commercial specification. Certain essential points, however, seem obviously to offer opportunities for tests: The per cent of copper, as determined by cross sections and resistance; the resistance itself; the breaking strain; and the nature of the weld of the two metals. The breaking strain, resistance and cross sections can be told by methods indicated for ordinary copper wire. The nature of the weld can be told after a sample

section has been properly polished and etched and examined under the microscope. An apparently practical test, also, consists in bending the sample around a mandrel of stated size and coating it with a prepared solution of gelatin, water, sulphuric acid and potassium ferricyanide; the exposed iron showing up as a blue coloration of the gelatin. Both these tests are, however, somewhat new and I am not at this time fully prepared to pass on their value.

Much can, however, be told of the value of the copper coating by examining bent samples of copper steel under a good glass or microscope.

Galvanized-iron wire is, in a way, analagous to copper-steel wire except that it lacks the low resistance qualities of the former. Similar tests are, however, called for in the way of cross-section measurements, weights, resistance, tensile strength and the value of the galvanizing coating. All except the tests on galvanizing coating are like similar tests on copper and copper-steel wire and the coating tests are, in a way, analagous to those for tin coating on copper. The solution is different; to test for galvanizing a copper-sulphate solution is used, and in cast of poor galvanizing a deposit of copper shows on the exposed steel. Bending tests around mandrels of stated size are also of value as showing whether the galvanizing will crack, although these latter are considered by some engineers as not practical, as a galvanizing coat thin enough to stand appreciable bending will not give to the wire the protection against weather which should obtain. Also the claim is made that where this galvanized wire needs to be bent in splices, it is impossible to get any galvanizing of value ductile enough to stand the short bends that are required. Further than this, splices in question should always be specially protected so that any exposed iron, due to cracking of the galvanizing, will not rust.

Factory Tests on Telephone Cable.—Lead-covered cables, in a way, are the most important, I believe, of any class of conductors used in telephone service; this on account of the large number of circuits they contain, the fact that they are generally placed underground and hard to test and repair, and also because they are expensive and costly to install. The tests called for here are conductivity tests, capacity tests, high-voltage and insulation-resistance tests and tests on paper used for insulation and the thickness, quality and application of the lead cover. The resistance, capacity and high-voltage tests require the same factory apparatus called for in tests on rubber insulation and, in addition, special testing apparatus to measure electrical capacity. These tests are mostly made on cable not immersed in water, although sometimes this latter is required on voltage and insulation-resistance tests, although, unless some reason exists for doubting the manufacturer's ability to lead his cable, the water immersial seems to be an extreme requirement, and a test without water immersion, together with the manufacturer's guarantee on this point, would seem to be all that is essential. The tests on the lead covering itself are, first, as to thickness, which is a direct measurement; and then whether the lead is composed of the proper material; this being in the nature of a chemical analysis to determine the quantities of tin, zinc, etc., and whether these are in such proportions as to make a ductile and durable cover.

Cable Paper Must Resist Moisture Penetration.—The quality of paper used as insulation on the wires is important; it should be tough, of good quality and treated so as to resist absorption of moisture, although leaded paper cables are supposed to be entirely free from moisture, and the lead is to keep all moisture out, while the sole function of the paper is, I believe, to form the necessary mechanical separation of the individual wires from each other.

Why Inspection of Material Pays.—So much for technical and specific points. There is also a decided commercial value to specifications and tests and inspections at factories, in that such specified, inspected and tested wire is more carefully made up by the manufacturer, for his own protection, and, according to his skill, with a greater or less margin of safety than actually required. This is done on the theory that some of his material will always average below the balance. Again inspected materials are treated with more care in shipment, as damage in handling could be more easily traced. Again, these shipments are more prompt and complete, as there is a representative on the spot following them up; and where certain lengths are specified or methods of shipments, reels, coils or certain size of coils, tracers, twists, etc., these can be checked up more easily by factory inspection than in any other way.

The purchasing agent working with a proper specification will obtain samples promptly when shipments are made and can see for himself their general characteristics; these samples, properly tagged and set aside by him or, in any event, similar samples set aside by the inspection bureau, will keep an actual record of this particular lot of material and afford a valuable check against improper handling of it by linemen in the field.

In conclusion, I have not meant to carry the idea that specifications and factory inspections and tests are a panacea against all wire troubles, but simply to claim they are of considerable value in reducing the same and, if properly made and followed up, will serve as one of the many checks which mark the difference between the well-managed company and those exercising less business care and ability.

Telephones in Dominican Republic

Consul Philip E. Holland, Puerto Plata, says there is no general telephone system in use in the Dominican Republic. The government operates long-distance lines between all cities and towns, but the messages are transmitted through the operators, as no conversation is permitted except between state officials.

Realizing the urgent need of such system, an executive order was issued on November 24, granting concession to anyone, under certain restrictions, to build and operate urban telephone systems in any and all cities and towns in the republic. The several systems will have no long-distance connection with other cities, unless authorized by special concession. The maximum charge for telephone service will be $3 a month. The government officials are to be given gratuitous service. Only one system will be allowed in each city. The order provides that anyone obtaining a concession must begin work on the construction within one year from the date of the concession.

Since the executive order was issued, concessions have been granted to build and operate telephone systems in Puerto Plata, Santiago de los Caballeros, and San Francisco de Macoris.

German Operators Old in Service

The German telephone girl gets her job through a civil service examination and usually hangs on to it for life, according to the *Telephone Review*. Her average age on entering the business must be near 30. As she can stay until she is 70 (but no longer), one sees many operators whose age it would be ungallant to guess.

Novices go to a training school, but are not paid while there, and the drill in practical operation is complicated with a good many technicalities of construction. On entering an exchange an operator is paid about 60 cents a day.

She has four cents a day increase each year until the eighth or ninth, when she is established and cannot be discharged without considerable red tape. When she has worked up to $450 a year and $50 extra for house rent, she stays at that pay until retired on pension.

On the back of each operator's chair are two bags, a black one to hold head rest and service property, and a brown one for her lunch and personal property. Operators freely talk back to a hostile subscriber and pleasantly pass the time of day with a friendly one. They apparently talk to one another with little restraint while at the board.

Working hours are about ten a day. Girls work the board from 6 a. m. to 10 p. m. Night operation is done by men, paid double wages, and they repair cords and work about the board as well as answer calls, for the night traffic is very light.

Supervisors are not so numerous as with us, and handle fifteen to twenty-five operators upon lines that do not tend to produce the quick service our public is accustomed to. The cardinal virtue of the German service is its cheapness and the cardinal defect its leisureliness.

Berlin's calls average 2½ cents apiece, and it is possible to talk nearly 400 miles for 25 cents. But the German exchequer, of course, bears the burden of a deficit, on the same plan as Uncle Sam's postoffice.

One excellent practice universal in Germany Americans might well adopt. Telephone managers are now trying to bring subscribers to identify themselves when answering the telephone. Every German does it, for instead of answering "Hello," the form of answering is invariably "Hier Karl Schmidt," or "This is Karl Schmidt."

Long distance operators identify themselves by their towns, so that when Frankfort-on-the-Main is rung up from Berlin the operator says, "This is Miss Frankfort," or "Hier Fraulein Frankfort." The "Fraulein" is never left off.

When long distance is cheap it is also crowded through the day, and considerable time is needed to get a message through as a rule. The Berlin operators on long distance speak several languages, as they are working with French, Italian, Russian, Swedish, Dutch and other operators.

The ober-inspektor at Berlin gave one amusing fact on this point. While all his operators handling traffic to Paris speak French, learned in the thorough German fashion, only one or two long-distance operators at Paris condescend to speak German.

Some of the exchanges have comfortable lunch rooms where coffee is served to the operators, and all will have them in time, it was said. The telephone service in Germany is like most business there in that the employes have two hours for a hearty meal in the middle of the day and go home to take a nap. Peaks in the traffic come at two points—9 to 11 in the morning and 3:30 to 5:30 in the afternoon. A double charge is made for night traffic, and so it is light.

"Information" is also rather a placid person, and complaints are handled upon a system which furnishes many contracts to the American practice. It is said that an operator will often enter into a detailed discussion with a subscriber who asks for a firm whose number he does not know and finally turn him over to "information" reluctantly.

When the call comes to the information desk the operator there has little but the official telephone directory to go by. If that will not answer the question it commonly goes begging. The directory is issued once a year, and not even the list of new subscribers is posted promptly at the desk. If a complaint comes in, too, the operator will frequently discuss the matter with the subscriber, especially in the case of a wrong connection or premature cut-off.

If she cannot establish an alibi and it goes further the supervisor or inspector reprimands her for that particular offense, but nothing else happens. If the complaint gets as far as writing, the authorities reply, stating to the subscriber that both parties are at fault and they will try to correct the shortcoming. The subscriber's letter is read to the operator with a caution.

One inspector said that the operators handle three complaints to his one, but added that this was largely the fault of the subscribers, who have the habit of taking up trouble direct with the operator. If an operator complains that a subscriber has insulted or sworn at her, the subscriber can be fined or have his telephone taken away.

Telephones in Germany

Consul General Robert P. Skinner, Hamburg, Germany, says that as the telephone service of Hamburg, and for that matter of all German cities, is under the management of the Imperial Administration for Posts, Telegraphs, and Telephones, it is entirely impossible for American firms to procure any business from the merely local administrations, and, owing to the development of the German electrical industry generally, it will not be easy for them to obtain orders from Berlin.

The present population of Hamburg is 932,166. The type of switchboard in use in the telephone building is that of the central battery system, Aven, of Swedish invention. At present an average of 800 lines are connected to each switchboard; 14,000 more subscribers may be connected with the present equipment, which has been in use since July 10, 1910, only and has been giving satisfactory results. The present connections number about 40,000, and it is proposed to increase the equipment for the accommodation of as many as 80,000, which would be the extreme limit of the present telephone building. The switchboards were built in Berlin.

Juror Questions Telephone Summons

Whether a summons served upon a juror by telephone is legal service is the question raised by George F. Meacham at Seattle, Wash., after Judge J. T. Ronald indicated a purpose to fine him $10 for contempt of court for failing to answer a summons to serve as a juryman.

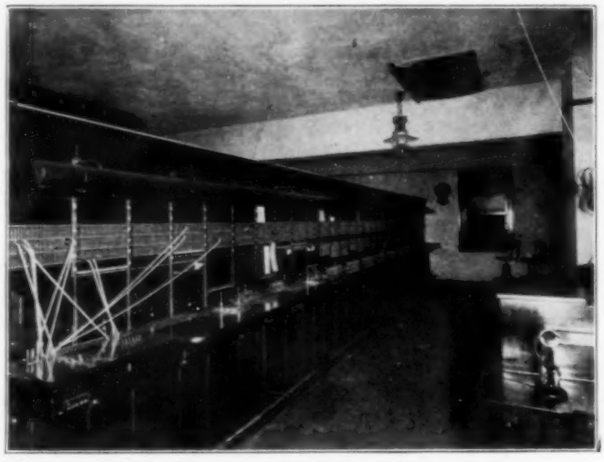
Equipment of the Middletown Exchange

By Charles F. Morris

THE Middletown, Ohio, Telephone Company has recently completed extensive improvements at its main office in Middletown, Ohio. This new exchange, which is located in a building 80 by 25 feet, is especially well laid out, and all of the apparatus is of the latest design.

Entering the public office, one finds the manager's office and general offices to the right and the operator's retiring room to the left. Back of the retiring room is located the apparatus room and the operating room.

The present equipment consists of five sections of six panel No. 1 Western Electric switchboard, each section having three operator's positions, while the ultimate capacity of the switchboard is seven sections. At present there are fifteen operators' positions installed, fourteen of which are equipped. These are divided as follows: One testing position, four toll positions and nine subscribers' positions. The present capacity of the board is 3,000 common battery subscriber lines, 1,800 of which are now equipped. These common battery line circuits are equipped with line cut-off relays, which make them free from dangling grounds during connection. There are also forty toll lines now in service.



The Middletown Operating Room.

The switchboard represents the latest development of engineering and manufacturing skill. All of the apparatus is mounted on a rigid iron frame made up in sections and firmly fastened together. The woodwork really acts as a covering for the apparatus mounted on the frame, and is of mahogany. The end positions are provided with removable end panels, which will allow for the two additional sections when they become necessary.

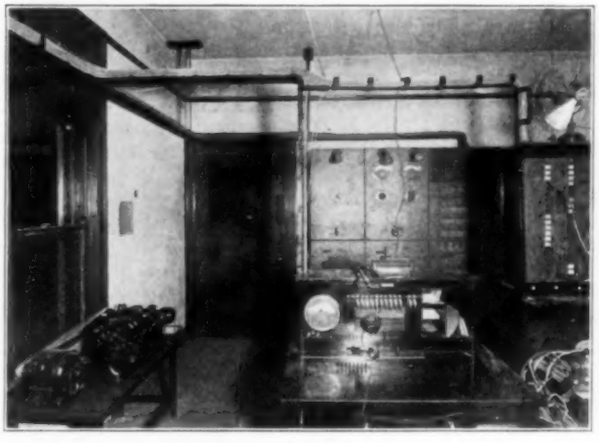
The first position of the switchboard is equipped for testing and is provided with a switchboard testing circuit and three testing operator's cord circuits. This position is also equipped with fifteen test and plug-up lines for plugging up lines that are in trouble. When the trouble is cleared, the operator is automatically signaled, which allows her to take down the test lines.

The Middletown Terminal Room.

The next four positions are for the toll operator, and these positions are equipped with the proper cord circuits for handling all toll calls. Two calculagraphs are also provided. The remaining nine positions are for subscribers' lines. This switchboard is equipped with line cut-off relays, which make all lines free from dangling grounds during conversation.

Another feature of the switchboard installation is the lighting equipment. The front of the switchboard is provided with trough-type reflectors, which give an even distribution of light over the face of the board, while the rear of the switchboard is provided with lamps to allow easy inspection of the apparatus. Both a chief operator's desk and a wire chief's desk are provided. The chief operator's desk is equipped with circuits which give strict supervision over operator's at all times. The wire chief's desk is fully equipped with the necessary lines for making tests on both the switchboard and the lines.

A feature of this installation is the peg-count meter equipment. The chief operator's desk is provided with a peg count meter for each "A" position of



Wire Chief's Desk and Power Apparatus.

the switchboard. At each operator's position a key is provided which enables her to register every call.

A combination main and intermediate distributing frame for terminating the line switchboard cables, is the type that has been installed. This is fitted on one side with No. 84 protectors and on the other with terminals for outside cables and terminals for the proper cross connections for the multiple and answering jacks. The line and miscellaneous relays are all mounted on a steel relay rack.

All circuits are fused individually at a fuse board. This fuse board is equipped with Western Electric alarm-type fuses, which enable the attendant not only to see at a glance the particular bar in which the fuse is blown, but, in addition, enables him to locate at once the particular fuse which has blown. On this board the signaling and talking battery current busbars are separated, so as to eliminate noise and induction trouble.

The power equipment for the exchange consists of a motor generator set, two sets of storage batteries, a power switchboard, a power protection panel, two ringing machines and the necessary auxiliary apparatus. The motor generator set is made up of a 50 ampere generator, connected by a flexible coupling to a single phase a.c. motor. An auxiliary gas engine is provided for emergency use, which can be belt connected to the generator. One set of batteries is used for 24 volt local talking and consists of eleven type "F" elements. The toll talking battery consists of eleven "D-5" elements, and, being 48-volt, insures good transmission on long distance calls.

The switchboard, power plant and all the auxiliary apparatus was manufactured and installed by the Western Electric Company.

"Phone-voyance," or Telephone Clairvoyance

In a cablegram to the Washington (D. C.) *Star*, William T. Stead describes some of his experiments in telepathy, which involve the telephone. He says:

"The keen interest taken by Americans in some experiments which I conducted a few years ago with a Nottingham gentleman for the transmission of words by telepathy from Nottingham to London leads me to think that it may not be without interest if I describe the latest and still more remarkable phase of telepathic clairvoyance.

"A performer at the Alhambra Music Hall, who had been giving thought-reading tests, undertook to demonstrate that she possessed the faculty of using the telephone for the purpose of visualizing objects at the other end of the wire. Two committees were formed, one sitting on the stage of the music hall, the other in the Daily Mirror office. Members of the committee handed to the performer's husband at the Alhambra articles which they produced from their pockets, and his wife, who was at the newspaper office a mile away, described the articles in question and generally with accuracy.

"But the existence of this faculty of phone-voyance has long been known to me, its original discoverer, to the best of my knowledge, and belief, being Vincent Turvey, a retired business man, who is living at Bournemouth. How he first came to make this discovery he described as follows:

"November 11, 1905, Mr. Sharpe, a neighbor, rang me up on the telephone to ask a question. When I had answered the inquiry, he said: "I must go now, as I have a friend here." I replied, "Yes, I see you have." He said, "You don't mean to say that you can see who it is?" I said, "No; I cannot see who he is, but I can describe him to you."

"'I then proceeded to accurately describe the gentleman's face, hair, eyes, hands, stature and mustache, adding: "He wants a shave." I mentioned that he was sitting in an armchair with his legs crossed, and one arm on the arm of the chair. While this description was being given Mr. Pontifax, that is the name of Mr. Sharpe's visitor, rose from the chair and went and leaned on the mantelpiece with one elbow, standing up to do so with his legs crossed.

"'After that Mr. Pontifax came to the telephone and asked for further demonstration. The ability to 'see' was fast slipping away from me; but I was able to describe one or two articles on him. He then cross-questioned me, in order to find out if I had seen him before, and I was able to convince him that I had never heard of him.'

"That was the first occasion on which Mr. Turvey was able to see, as it were, through the telephone. He made subsequent experiments with considerable success. In the first the distance between the seer and the seen was not much more than one mile. In the next experience the parties were separated by nearly 100 miles.

"In one case Mr. Turvey rang up a Mr. Lane to ask him for the return of a book.

"'When Mr. Lane came to the telephone,' says Mr. Turvey, 'I could distinctly see a long, narrow passage; at the end of the passage I could see a pair of hands, wrists and forearms, evidently a woman's.

"'These hands appeared to be busy in or around a bowl, in the way one would expect them to be if the owner were shelling peas or washing her hands. I knew it must be Mrs. Lane, as her husband, to whom I gave the description, called her and I heard her through the telephone (normally) reply to him.

"'Mr. Lane informed me that his wife, before she came to the telephone, had got up from serving sweets at the dinner table, which were in two glass bowls.'

"All that I need to add to these records is that I am personally acquainted with Mr. Turvey. I have been a guest at his house, and I can guarantee that he is of the utmost propriety and a very painstaking observer. He does not look through the telephone, only when he puts the receiver to his ear he sees occasionally what is going on at the other end."

The Employee and the Company

The Postal Telegraph and Cable Company has issued a card whose contents, written by Vice-President E. J. Nally, is worthy of extended appreciation:

It is a fact that the public regards the representative it meets and with whom it transacts business as the company itself. We know this from our personal experience in stores, if they are pleasant and affable, if they impress us by their alertness and their knowledge of their business, our trade naturally gravitates toward that store. We like to go there; we are glad to tell our friends about it and to influence their patronage in that direction.

So it is with the representatives of the Postal Telegraph. The public receives its idea of the company largely through you. You are the ones they meet and from whom, as a rule, they form their impression of the company itself. Hence it behooves all to be efficient, alert, honest and obliging, since in so doing we not only build character for ourselves, but we likewise give character and reputation to the company we serve.

The Law and the Telephone

By E. J. Wenner

DAMAGES CLAIMED FOR TRESPASS—POLES WRONGFULLY PLACED ON LAND.

MR. R. W. Kirk, residing near Owensboro, Ky., has brought suit against the Cumberland Telephone and Telegraph Company, claiming $250 damages on account of a trespass by defendant. It is claimed that the trespass consists in erecting poles and stringing telephone wires thereon along the north and west side of plaintiff's land and within twenty feet of a hedge fence. Plaintiff claims that the proximity of the telephone line makes it exceedingly troublesome and expensive keeping his hedge in proper condition. Plaintiff claims the trespass has existed for a period of five years and that the damage for the period of time covers amounts to $250.

DAMAGES CLAIMED FOR REFUSAL TO ALLOW PATRON TO USE TELEPHONE.

Charles H. Bedwell of Sullivan, Ind., has brought suit against the Sullivan Telephone Company in which he asks $100 damages for a refusal to allow him to talk over the toll lines to a party at the town of Dugger.

Defendant claims to have based its refusal upon Bedwell's failure to pay a $.20 toll charge. The case will be tried by plaintiff on the theory that he was not obliged to pay the toll charge, and by defendant on the theory that he had no right to use the toll lines without payment of such charge.

TRAINMAN INJURED BY LOW WIRE—DAMAGES RECOVERED FROM TELEPHONE COMPANY.

John V. Gobershock, a freight conductor on the Chicago, Milwaukee & St. Paul Railway, while upon the top of one of the box cars in his freight train was caught by a telephone wire belonging to the McLeod County Telephone Company and severely injured. The accident occurred at a point near the town of Glencoe, Minn., where the telephone line crossed over the railroad right of way. The wire had been allowed to sag and had been in a dangerous position for ten days or two weeks prior to the time of the accident. The wire came in contact with the plaintiff's face and struck across the bridge of his nose and across his left eye, the particular injury being to the nerves of the eye.

The injured man brought action against the telephone company and received a verdict for $3,000. The telephone company appealed to the Supreme Court in Minnesota. The appeal was taken on the theory that the question of improper and negligent maintenance of the wire, which had been submitted to the jury in the court below should not have been so submitted. The facts are that the wire was properly fastened at the time of the construction of the line, but that it had become out of order and had sagged low and remained in that condition for some time.

The Supreme Court held that the evidence submitted made a case for the jury and that it was within the province of a jury to decide whether the defendant was negligent, and, that as no other error had been assigned, the decision of the lower court should be affirmed.

Gobershock vs. McLeod County Telephone Company, 131 *Northwestern Reporter*, page 1133.

ACKNOWLEDGMENT TAKEN OVER TELEPHONE HELD VOID—COURT DECIDES THAT PERSON MUST BE PERSONALLY IN PRESENCE OF NOTARY.

The Supreme Court of Tennessee in the case of Parlee Wester vs. Reuben Hurt, reported in 130 Southwestern Reporter, at page 842, decided that the deed of a married woman living with her husband conveying her general estate is void without personal, private examination by the notary taking her acknowledgment.

This decision is based upon the Statute of Tennessee, which provides that the acknowledgment before a notary is binding and of judicial force if, first, there was a personal interview between him and the signer; second, that this interview was private and apart from her husband; and, third, that the execution of the deed was confessed to have been made freely, voluntarily and understandingly and without compulsion and constraint from her husband.

The facts are that the plaintiff, who owned a small tract of land, joined with her husband in a deed of trust for the purpose of securing a debt, which her son owed to the defendant. After signing the deed it was taken to the notary public, who called Mrs. Wester over the telephone and took her examination and acknowledgment by telephone conversation.

In its decision the court makes use of the following:

"It is clear that if the officer taking the privy examination of the married woman does not have a personal interview with her, and does not propound the required questions to her while in her presence, he cannot determine judicially whether the deed has been executed in the manner and under the conditions that the law requires in order to make a valid conveyance of a married woman's estate. This is manifest from the language of the statute itself. The officer is to determine as a matter of judicial judgment that she did execute the instrument freely, volutarily, and understandingly, and without compulsion or constraint from her husband; and this he cannot do out of her presence, because her appearance, manner and demeanor may become more potent factors in ascertaining the truth of this than mere formal answers to questions.

"The language employed by the legislature in prescribing the form of the certificate made by the officer taking the examination precludes a construction which would uphold an acknowledgment taken in this way, and therefore it was clearly not within the legislative intent that this should be done.

"We are of opinion, therefore, that this attempted privy examination of Mrs. Wester was of mere empty form, unauthorized by the statute, and the certificate made by the officer, although it contained the proper words, does not establish the facts certified to. The decree of the Court of Civil Appeals, reversing the decree of the chancellor, is therefore affirmed."

It appears there are but two cases in addition to the above decision based upon the validity of an acknowledgment or oath taken over the telephone.

In Banning vs. Banning, 80 California 271, the validity of an acknowledgment to a deed was question for the reason that the signer was "not visibly and therefore

not personally present before the notary at the time he took her acknowledgment over the telephone, she then being three miles from him."

The court in holding the acknowledgment to be valid and proper uses the following language: "It is admitted that the certificate of the notary is in due form; and it is not alleged or pretended by the defendant that she did not voluntarily sign and deliver the deeds; nor that she did not voluntarily, and without the hearing of her husband, acknowledge the execution of them over the telephone, after having been informed by the notary of their contents; nor that any deception or fraud was practised to induce her to execute the deeds; nor even that the plaintiffs had notice of the manner in which it is alleged that she acknowledged the execution through the telephone. These particulars are not stated for the purpose of maintaining that, under any circumstances, an acknowledgment of a deed may be taken through the telephone, but for the sole purpose of showing that there is no pretense of fraud, duress or mistake."

This would establish the California law as holding that an acknowledgment to a deed taken over a telephone, if the certificate is in proper and legal form, is valid and cannot be impeached except where fraud is established.

The case of Sullivan vs. First National Bank, 83 Southwestern Reporter 421, holds that an oath to an affidavit which was required by statute to be administered in the mode most binding upon the conscience of the individual taking same, and be made by the affiant in the personal presence of the officer, cannot be administered over the telephone, although the officer recognizes the voice of the affiant.

In the decision the court makes use of the following language: "The law requires the affiant to be in the personal presence of the officer administering the oath; not to the end that the officer may know him to be the person he represents himself to be, for it is not required that the affiant be identified, or introduced, or to be personally known to the officer, but to the end that he be certainly identified as the person who actually took the oath." And then in considering the question with relation to a possible prosecution for perjury he continued: "It may be true that the officer, when he takes the affidavit of one well known to him, might recognize his voice over the telephone, and therefore be able to testify that he took the oath and made the affidavit in issue. But it must be borne in mind that the law does not require the clerk or notary to be acquainted with one who becomes an affiant before them. A stranger may appear, sign an affidavit, and demand that the officer swear him and affix his jurat. In that case the officer certifies and can swear to no more than that the man who affixes the name to the affidavit swore to its truth. The name he signed may have been fictitious, but the individual swore to it as the clerk or notary certified, and he would be subject under that name or his true one to a prosecution for perjury. Now, if the contention of appellant is sound (that personal presence of affiant was not required), the rule must be laid down broadly, and whoever might demand the official jurat by his personal presence might also demand it over the telephone. Had it not so happened in this case that the clerk was acquainted with Sullivan, and identified him by his voice, he could have done no more than certify that a man whom he did not know, but who represented himself to be Sullivan, authorized the name of Sullivan to be signed to the affidavit and swore its contents were true. The clerk could not possibly identify him as the one making the affidavit if the question should afterwards arise. In a prosecution for perjury, such testimony on the part of the clerk would not even raise an issue against the unknown affiant. So, we hold that not only is the personal presence of the affiant required, to the end that by appropriate form and ceremony his conscience may be bound, but that it required that the officer may see and know that the man who signs also swears. No modern business necessity requires the broadening of these rules. To allow the contention of appellant would be to open a broad road for fraud and imposition, and hold out to the perpetrators a tempting chance for immunity from discovery and identification."

Anglo-French Telephone Service

Recently the British Postoffice laid a new telephone cable in the Straits of Dover, and this has recently been connected to land lines from London and Paris, thereby providing increased and improved telephone facilities between the two capitals. By the extension of these circuits to provincial towns speech is rendered possible between places in England and France which could not previously communicate wtih each other, and, in order to determine the extent of the increased range, experiments have recently been carried out by English and French officials from a number of provincial towns.

Before the new cable was provided, no town north of a line connecting the Humber and Mersey could communicate with Paris, but in the recent trials it was found possible to converse with the French capital from Newcastle-on-Tyne, Glasgow and Edinburgh, and finally trials were made from Aberdeen involving a circuit length of over 900 miles. In the best conditions of line and apparatus commercial speech could be conducted from that place with Paris. These tests will enable the postoffice engineers to determine what other English towns can communicate with France.

The increase in the range of telephonic speech has been brought about by means of the new loaded telephone cable recently laid between England and France.

Ohio Commission Notes

A complaint filed by the Gratiot and Brownsville Telephone Company against the Brownsville Telephone Company constitutes the first telephone case before the new Ohio commission. The former company wants to restrain the latter from entering the field, on the grounds that additional service is not necessary.

Dunkards Finally Allow Telephones

The old order Dunkards have concluded a five days' session, near Delphi, Ind., and the much discussed question as to whether or not the church members shall be allowed to have telephones has been decided in the affirmative. Five members of the church, who had been expelled for having telephones, were reinstated.

Submarine Cable at Vancouver

At Vancouver, B. C., the British Columbia Telephone Company is contemplating the installation of a new submarine cable to Victoria, Vancouver Island. The new cable would accomodate three talking circuits, and be some thirty miles long.

Recent Telephone Patents

By David S. Hulfish

988,906. Receiver Case. Louis Steinberger, New York, N. Y. The hard rubber case has soft rubber rings at its large diameter or shoulder and at its smaller end. When laid upon a surface it rests upon the soft rubber cushion bands.

988,907 and 989,076. Mouthpieces. In these two improved transmitter mouthpieces the feature of improvement is found in forming the holes just in front of the diaphragm into a funnel shape, tapering inwardly or outwardly or in both directions.

989,133. Selector Mechanism for Automatic Exchanges. Amos F. Dixon, New York, N. Y., assignor to Western Electric Company, Chicago, Ill. The object of the invention is to control the position of a selecting brush by the action of an electro-magnet, yet to relieve the electro-magnet of the labor of moving the brush to the desired position. This is accomplished by using the magnet to set up a stopping condition for the brushes, then by moving the brushes by power from a continuously moving main shaft or driving motor until the stopping condition is reached.

989,191. Telephone Receiver for Multiple Connection. W. B. Relth, Chicago, Ill. The feature of novelty is found in the terminals of the flexible cord. By the use of the improved cord an additional receiver may be attached in multiple with the regular receiver of the telephone, either for listening with both ears, or for the convenience of another listener.

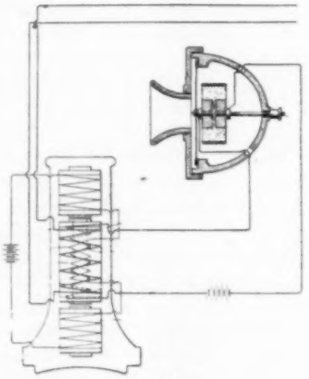
989,205. Telephone Switchboard System. D. L. Temple, Chicago, Ill., and C. L. Goodrum, Atlantic City, N. J., assignors to Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. A switchboard system comprising four-way jacks, three-way plugs and three-way cords, central energy, and differential relays in the lines for controlling the signal lamps.

989,212. Aerial Conduit and Cable Guard. Edgar M. Van Nostrand, Wabash, Ind. A cable guard comprising large tubular sections for enclosing the cable, small tubular sections for enclosing the messenger, flat web sections connecting them, and bolts for clamping the sections together.

989,231. Insulator Support. Wilbur L. Chamberlain, East Hartford, Conn. A house bracket in which the insulator may be adjusted to project from the house at any angle or direction, regardless of the position of the base portion secured to the house.

989,250. Submarine Telephone System. D. M. Gray, executrix of Elisha Gray, Highland Park, Ill., assignor to Submarine Signal Company, of Maine. An improved resonator is shown for imparting the waves of a bell tone to the water, the sound waves being detected by distant vessels by means of telephones carried by the vessels.

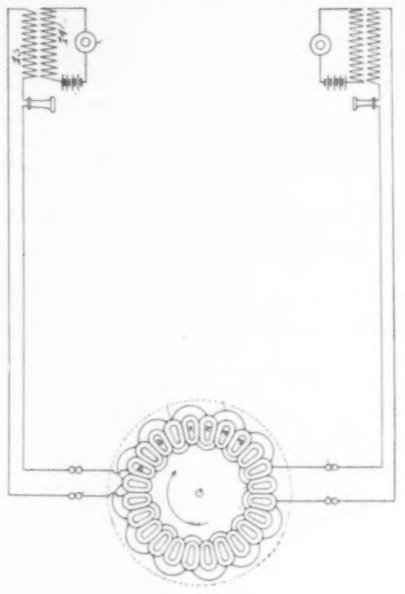
989,529. Conversation Counter. George W. Lorimer, Piqua, Ohio. An improved means for connecting a counter to an automatic telephone for counting the conversations, or completed calls. Novel features preventing errors in registering are embodied in the device.



989,856.

989,588. Cooling Device for Telephone Transmitters. Carl Emil Egner, Stockholm, Sweden. The currents carried by telephone transmitters in heavy long distance work, and particularly in repeaters using the variable resistance element, are so great that the heating effects limit the efficiency of the instrument. Mr. Egner provides a spiral pipe near the diaphragm, and passes a cooling liquid through it.

989,761. Telephone Lock and Call Register. Emanuel L. Buxbaum, Chicago, Ill. A casing is arranged to be secured upon the stem of a desk telephone immediately below the hook lever, containing a hook-locking bar and a register, and means for operating the register when the hook lever is lifted.



990,183.

989,762 and 989,763. System for Registering Telephone Calls. Emanuel L. Buxbaum, Chicago, Ill. Registers are provided for each line at the telephone and at the central office; means at the switchboard enable the switchboard operator to actuate both registers of a line simultaneously. A further means is provided at the sub-station for recording the length of conversation.

989,768. Switchboard System. A. H. Dyson, Chicago, Ill., assignor to Western Electric Company, of same place. Upon a busy line, the line and supervisory lamps are in multiple; when either is removed, the other is caused to glow, the supervisory lamp being further assisted by a derived circuit controlled by the line relay armature.

989,795. Attachment. John B. O'Hara, Philadelphia, Penna. A pad containing an antiseptic is hinged to swing into the mouthpiece funnnel when the telephone is not in use.

989,814. Auxiliary Telephone Receiver. Wilhelm Schwarzhaupt, Cologne, Germany. An auxiliary receiver, comprising a rubber tube, an earpiece for each ear, and means for attaching one of the earpieces to the telephone receiver.

989,856. Telephone Set. William C. Lockwood, San Juan, Porto Rico. The induction coil is combined with the receiver.

990,032. Relay. E. E. Clement, Washington, D. C., assignor to North Electric Company, Cleveland, Ohio. The bell-crank armature of the usual return-pole-piece relay is used in a relay having a pair of cores by the ruse of supplying a brass yoke over the front end of the cores to support the bell-crank armature.

990,183. Telephone Relay or Repeater. Charles G. Ashley, Chicago, Ill. An instrument for increasing the amplitude of wave-form current, including two windings directly out of inductive relation, for connection in different circuits, and an inductor for said windings and movable with respect to said windings, the inductor in co-operation with one winding effecting eddy currents in the inductor, which eddy currents are caused to be in inductive relation with the other winding.

990,210. Supervisory Signaling System. William G. Blauvelt, New York, N. Y., assignor to American Telephone & Tele-

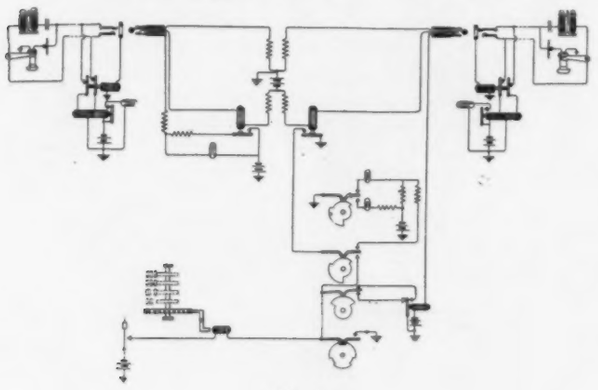
graph Co., of same place. By this improved system the signal of the calling plug of a cord pair is transferred to a different lamp after the station has answered, the release signal for the calling cord being thus different from the ringing or "no response" lamp signal.

990,229. Protector. Frank B. Cook, Chicago, Ill. An individual protector unit and means for mounting the same. A protector of the distributing frame type or pole top terminal type, of improved design and of compact construction.

990,275. Telephone Transmitter. Stanislaw A. Koltonski, Boston, Mass. A novel feature of the structure is that the ring for the diaphragm and the bridge for supporting the back electrode of the button are made in one piece.

990,365. Telephone Repeater System. Carl August Kruckow, Halle-on-the-Salle, Germany, assignor of part to McMeen & Miller, Chicago, Ill. Relays of the variable resistance type are used, two such relays being used for the repeating link. The circuits of the repeating link are of the anti-side-tone type, that the repeating link may not "talk back" or "sing" when in service.

990,468. Switchboard System. Frans Gunnar Agrell, Stockholm, Sweden. The improvement is found in the cord pair at a relay multiple central energy switchboard having party lines upon it. The cord pair is provided with means for indicating to the operator whenever a station calls for another station upon the



990,219.

same party line, thus preventing the giving of a "line busy" report when the calling station itself is the station making the line busy.

990,527. Muffler. Fred W. Cook, Denver, Colorado. The attachment is a voice muffler, preventing the voice from being heard in the room in which the telephone is located, and also preventing outside sounds, other than the speaker's voice, from reaching the transmitter.

990,638. Telephone Meter System. Gerald Deakin, San Francisco, Calif., assignor of part to McMeen & Miller, Chicago, Ill. The system is adapted to an automatic telephone system of the Strowger type. Current through the meter-actuating circuit is insufficient for the actuation of the meter until the called party responds; the meter then operates to register, and is locked until the release of the connection.

990,685. Signaling System. E. M. Torwin, Newton Center, Mass., assignor to Holtzer-Cabot Electric Company, Brookline, Mass. A vibrating device for producing the audible busy-back signal used in telephone exchanges.

990,972. Visual Call Signal. Knight W. Gale, Los Angeles, Calif. A semaphore signal upon the front of the telephone set is arranged to be tripped by the ringing of the bell and reset by the lifting of the switch hook lever. It is particularly useful where two telephones are near each other, so that the ringing of the two bells can not be distinguished.

991,260. Automatic Telephone System. Valerian Alexeeff, Enseli, Persia. A complete automatic system, with central office and substations, is shown. The central office switch is of the revolving type, electrically controlled, and comprises radial plungers which are controlled from the substation to effect the connection with the desired telephone line. The system is described as being applicable for exchanges up to a size of four hundred telephones.

991,304. Telephonic Relay. Peter Cooper Hewitt, New York, N. Y., assignor to Cooper Hewitt Electric Company, of same place. The device is an arrangement of mercury vapor chamber and telephone circuits in such manner that an amplification of the voice waves of the current is effected, thus providing another form of telephonic relay, or telephone repeater. The mercury vapor chamber, when placed in the magnetic field created by voice currents, replaces the variable resistance of the most common type of telephonic relay.

Brown Telephone Relay In Wireless

Some time ago TELEPHONE ENGINEER published a description of a telephone relay invented by S. G. Brown, London, Eng. The following letter relates some interesting experiments with the Brown relay in wireless experiments:

We have recently made some experiments with a Brown telephone relay in connection with our wireless telegraph installation, and the results obtained are, I think, sufficiently striking to be of general interest. One of the aerials at the Central Technical College consists of a single wire suspended between a chimney stack on the college and the tower of the Imperial Institute. The length of the span is about 530 feet, and the height of the upper end about 260 feet. When it was erected it was thought that it might be possible to pick up the signals sent out from the transatlantic station at Glace Bay, Nova Scotia. The distance is about 2,400 miles. No success attended our efforts, however, even with special apparatus designed for the purpose, until we introduced a Brown telephone relay between the detector and the telephone receiver. With this arrangement the Glace Bay signals can be heard quite distinctly at night, but on account of atmospherics they are not always readable. When the other transatlantic station at Clifden, Galway, is working one can put the telephone receiver on the table and walk to the far corner of the room, 30 or 40 feet away, and still read the signals with comfort, even when the primary and secondary coils of the receiving transformer are 4 feet apart. Under similar conditions without the telephone relay the receiver has to be held near the head. Although the height of the aerial is 260 feet, which is about the same as that of the aerials used for the transatlantic work, it must be remembered that it is only a single wire, and moreover, since the tower of the Imperial Institute lies due west of the Central Technical College, the directive effect will be very unfavorable to the American signals. The fundamental wave length of the aerial is about 900 meters, while the wave length employed by Clifden and Glace Bay seems to be about 6,100 meters. These results show what an important addition a telephone relay must be to a wireless station receiving very weak and hardly readable signals. By enabling the coupling to be made much weaker, without lessening the sound in the telephone, it will also make it easier to tune out signals of nearly the same wave length.—G. W. O. Howe.

International Telephone Lines

The Swiss government has announced that the bill concerning the establishment of telephonic communication between Milan, Zurich, Basel, Frankfort, and Berlin has been passed by the Italian parliament. The proposals for the new telephonic lines have still to be ratified by the authorities in Germany, Italy, and Switzerland, but this is a mere matter of form. Tenders are to be invited for the construction of these new lines, and it is expected that the work will very soon begin, but, as the shortest line between the different places must always be chosen, a new plan of the telephonic route has to be made. The railway lines are not to be followed, nor are the highroads, for it is intended that the new line shall be reserved exclusively for the telephone. The lines from Milan to Basel and from Milan to Basel and Frankfort will pass through the Simplon tunnel and go via Lausanne, whence the shortest route will be taken to Basel. It is said that the establishment of these new telephonic communications will be one of the largest undertakings of the kind to be carried out in Europe next year.

DEPARTMENT of RAILWAY TELEPHONES

The Louisville and Nashville's Telephones

By K. W. Endres

THE Louisville & Nashville Railroad people have not been saying much about their progress in keeping up with other railroads on the telephone question, but those in position to know have long since realized that the plans as laid out are sweeping in character and designed to give the railroad one of the most complete and efficient telephone systems in the country when finished. They have been quietly building high grade copper metallic circuits and equipping division after division, and as quietly placing same in service until telephone people at large were attracted to this big idea and understood that the L. & N. were far advanced in the telephone game and were to be reckoned with in the telephone world. Already seven full divisions have been equipped and are in active operation, covering over nine hundred miles of road, single and double track, with a total of nineteen telephone circuits, and plans are being considered to extend the system over the entire road with a mileage close to six thousand.

Chief Dispatcher's Office at Middleboro, Ky.

A glimpse at the service will no doubt be interesting to the telephone public. The apparatus employed is all of the Western Electric Company's manufacture, including both telephone and selector equipment. Views of the dispatcher's office at Middlesboro, Ky., are shown herewith. The dispatchers are equipped as is usual on these circuits, with a chest transmitter and head receiver which they can conveniently wear throughout their trick without trouble. The key box, employing the unit type key, is located in front of the dispatcher. The arrangement of these keys, permitting any key to be removed or changed in the circuit without any interference with any other key, has proved a very popular feature of this portion of the equipment.

One of the illustrations shows the terminal apparatus at the same office; how the line goes out through the retardation coils and condensers; thence through the protector to the outside line.

The testing panel used on the L. & N. circuits is also clearly illustrated in this picture, permitting simple switching and patching arrangements to be made in case of trouble on the two circuits.

A typical way-station, showing the selector sets mounted on the wall at the left of the picture, is illustrated also and the switching panel is mounted just above these. The selector sets are of the central energy type, employing the No. 50-A selector of the Western Electric Company's manufacture.

The telephone arm is shown over the operator's table.

The wires being constructed are No. 9 B. & S. G., weighing 210 pounds to the mile, are put up according to the best and very latest engineering practice.

In working out the general telephone scheme it was figured not only to cover every division with dispatching telephone serv-

Department of Railway Telephones

This department is established as a permanent feature of TELEPHONE ENGINEER. The progress of the art of telephone train dispatching, its technical development, its news, and the elucidation of its mysteries for the non-technical worker will be found each month in these pages. The editors invite the problems and solicit the co-operation of the many readers of TELEPHONE ENGINEER in all parts of the world whose interests lie along these lines.

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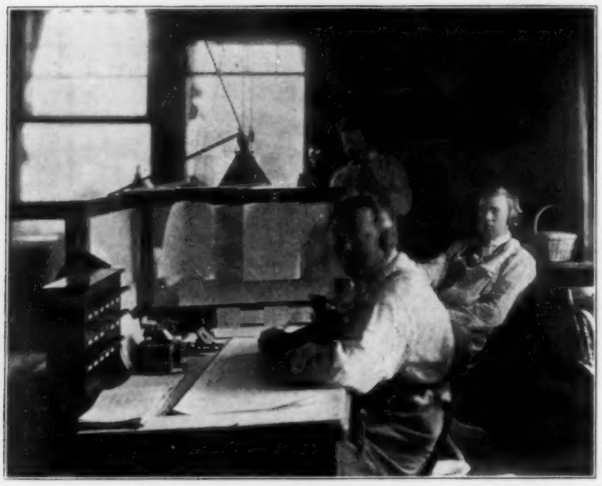


L. & N. Dispatcher's Office at Middleboro.

ice, but to arrange for the handling of local messages by telephone, and at the same time provide a means for through telephone communication from the general offices to all division headquarters and between division officials, aside from the local telephone message wires. For this purpose, therefore, it was early arranged to transpose the circuit for phantom service and this plan has been carried out. The general offices of the company are at Louisville, from which point the road runs in three directions; south to Nashville, Birmingham, Montgomery, New Orleans, Pensacola and all important centers in the Southland; southwest to Knoxville, Middlesboro and Atlanta; east to Cincinnati, connecting with the Pennsylvania Lines to New York and other eastern points, and another eastwardly line to Frankfort, Lexington and points in eastern Kentucky. Telephone lines are under construction that will cover all this territory and bring every division terminal in immediate touch with the general officials. In working out the scheme it was apparent that the distant divisions were to be first equipped, and allowed to get in a settled working condition, then gradually to build towards the general offices, so that when connected up a complete and efficient system would be immediately available.

Way Office at Cumberland Gap.

The railroad company has a number of large private branch exchanges which it is figured will be connected up with the independent railroad lines. At the general offices at Louisville the private branch exchange has a total of one hundred and seventy-five stations, with five operators, and fifteen trunk lines to the main exchange of the telephone company. Another private branch exchange is located at South Louisville with a total of forty stations, and this exchange is connected to the general office exchange direct by cable, and calls are interchanged without going through the main exchange. Private branch exchanges are also located at Nashville, Birmingham, Cincinnati, Atlanta and other important cities on the road, and these exchanges will also be connected to the independent lines.

The phantom equipment being installed will be found interesting and rather new in design, though thoroughly practicable. The phantom lines terminate at Louisville, working over train and message circuits to Nashville, thence repeats into another phantom to Birmingham, and again at Montgomery, Ala., to Mobile and New Orleans, taking a number of telephone circuits in its route. In this way the general office will have private and first-

Dispatching Equipment at Midddleboro.

class communication with all division headquarters without interfering with the ordinary traffic.

Another item of interest to railroad people is the method used by the L. & N. to cover telephonically some of the smaller divisions or branches without much expense. It was found that where the mileage was not excessive it would be practicable to utilize the present iron telegraph circuit as one side of a metallic telephone, and by building another iron wire to make the change from a grounded telegraph to a metallic telephone circuit at small expense, and with great success, and this plan will be carried out extensively where the distance is not prohibitive. These short circuits are connected in multiple to the main line copper circuit without in any way lowering the efficiency of the latter and are being worked direct by the main line dispatcher, who in this way is able to get into direct communication with branch points where he formerly had to relay Morse messages and orders at the junction, making a great saving in time and eliminating considerable danger of error.

The feature of communication by the train crew di-

rect with the dispatcher is being taken care of to an extent that is also interesting. Instead of placing telephones in cabooses and on trains which limits their service, booths have been constructed and placed at all sidings, bridges and tunnels, and in fact wherever it is figured that any trouble would be likely to occur. These booths are equipped with full telephone apparatus, and so arranged with switches that the telephone can be cut on either the dispatching or message line instantly. Train crews are, therefore, able to send messages as well as call for train orders, and the booths and telephones are available for section foremen who might wish to communicate with the dispatcher in case of bad track or for various other reasons for the benefit of the service. In addition to this, however, small hand sets, equipped with folding line poles are furnished for each wrecker and work train so that the phone can be cut in instantly if desired at any point on the line between booths or stations. In fact it has been the aim to make the wires available anywhere and at any time, and as will be seen, this object has been achieved. It has been reported that the saving in overtime on account of the ability of the dispatcher to move freight trains by means of these booths has been so great as to pay for the booths in a very short time. Where there were formerly delays of hours to freight traffic this has been almost entirely eliminated on account of the readiness and ease of communication.

However, with all the telephone facilities that are going in, the railroad company has not neglected or overlooked the telegraph service. When a division is equipped with telephones, the local Morse wires are cut out of intermediate offices, and form a part of a through telegraph system that is becoming daily more efficient and thorough, and the telephone circuits are also being simplexed giving another through Morse circuit without interruption. If the present activities are continued, the railroad company will soon have a most complete telephone and telegraph system covering every part of the line, and communication so necessary to the transaction of railroad business will be rapid and reliable.

Economical Spacing of Telegraph Repeaters

By Frank F. Fowle

AMONG the interesting economic problems in telegraph practice which seems to have had little attention is that of finding the most economical spacing of automatic repeaters in long telegraph circuits. In general practice repeater stations are used as little as possible, or only when the total distance of transmission exceeds the operative limits of the standard line conductors. Telegraph wire plants are made up very largely of No. 9 B. & S. harddrawn copper and No. 8 B. W. G. double-galvanized BB iron. The operative limits of these conductors under average conditions, as determined from the leakage theory of the Morse system,* are 437 miles for No. 9 copper and 253 miles for No. 8 iron, on through circuits with single working. Circuits of No. 9 copper are sometimes worked up to 500 miles without repeaters, but rarely for longer distances. The trans-continental quadruplex circuits, about 3,000 miles in length, are usually worked in six sections with five repeater stations; but the line conductor is normally a 300-pound copper wire.

Circuits of No. 8 iron are sometimes worked 500 to 600 miles without repeaters, except in wet weather; then repeaters are cut into circuit somewhere near the middle of the line. This practice appears to be economical because the annual charges on the iron line are less than those on the copper, but, as a matter of fact, the savings are about offset by the cost of repeater attendance and the extra cost of current supply, assuming the best quality of service. If the repeater attendance is cut down somewhat, so that the service will not be quite as good, there may be a slight final saving, but not a very material one.

Looking at the problem from the standpoint of a wire plant already laid out and constructed, with present wire standards, the use of repeaters is fixed largely by the operative limits of the present conductors. But fundamentally the problem has a much broader significance. Assuming for the moment that automatic repetition of Morse transmission were not possible, it is quite apparent that in order to operate long distances we should need to employ low resistance conductors and that the greater the distance the lower

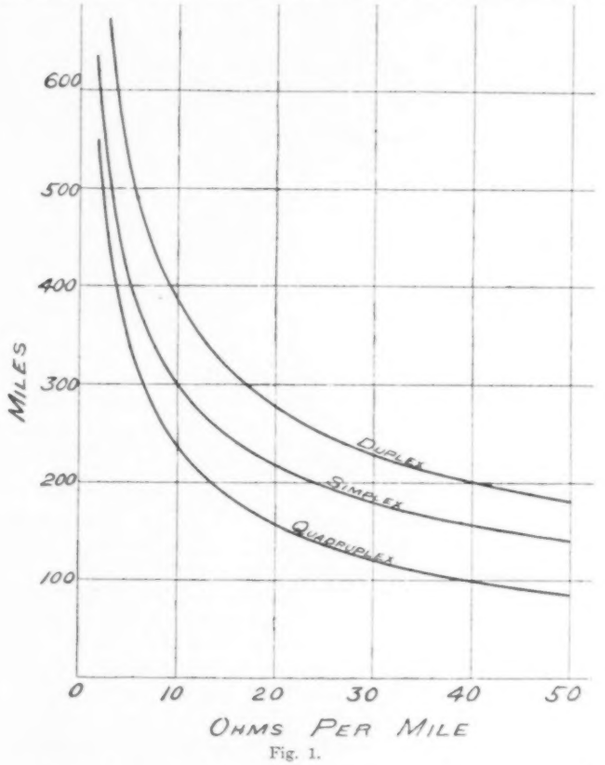


Fig. 1.

would be the permissible resistance and the greater the cost per mile. The cost of the line wire alone increases faster than the cube of the length of the line; but the total cost of the completed line increases less rapid-

*"Telegraph Transmission," a paper read before the Am. Inst. of Elec. Eng., June 28, 1911.
"Line Conductor Requirements for Telegraph Transmission," a paper read before the Association of Railway Telegraph Supts., June 27, 1911.

ly, due to the influence of other costs, which are nearly in linear proportion to the length. Nevertheless, the total cost increases faster than the square of the length, but less than the cube of the length.

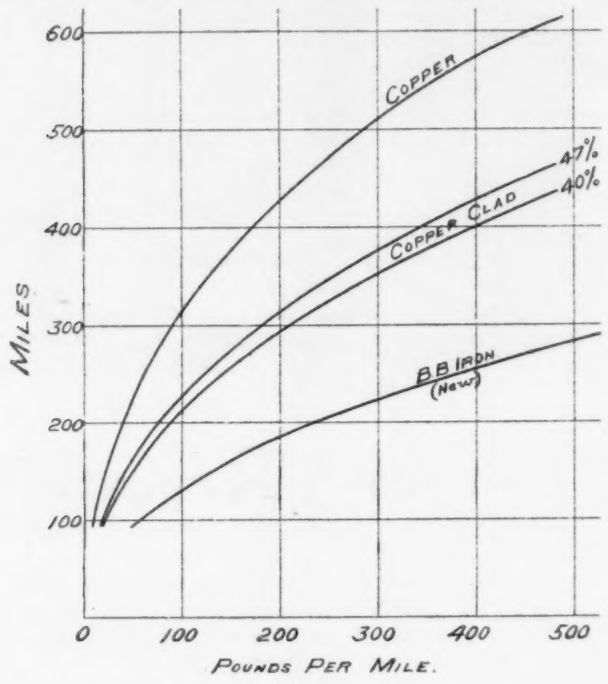


Fig. 2.

This is far from being an ideal situation. What we would desire, if it could be obtained, is a type of transmission in which the total cost increases no faster than the linear ratio of the lengths—that is, double length would mean double cost and no more. Probably that is impossible, but the use of automatic repeaters will evidently bring us much nearer the ideal result than we could otherwise hope for. This can be illustrated by the following case. A 500-mile simplex (or single working) line requires theoretically a copper conductor weighing 285 pounds per mile; but when this line is split into two sections of 250 miles each, by means of an automatic repeater station at the middle of the line, a conductor weighing 60 pounds per mile will suffice. The latter will not be admissible mechanically, of course, but it serves to illustrate the general principle. And it becomes fairly apparent that the use of repeaters ought to be one of the important considerations in selecting standard line conductors for a telegraph wire plant.

The problem is essentially one of transmission economics, and therefore its solution requires a rather elaborate study of costs. The underlying theory of transmission which will be here employed is that already given in the author's papers before mentioned. The relation between line conductivity and length is given in Fig. 1, which is taken from the previous work. Using these values of conductivity, or resistance, and the values of the mile-ohm given in expression (1), the relations between conductor weight and line length are readily found, as shown in Fig. 2.

H. D. copper, 68° F.	895 lbs.
47% copper clad steel	1,775 "
40% copper clad steel	2,075 "
Galvanized B. B. iron	5,600 "

The cost data is compiled from market prices which were current about July 1 of the present year, and is given in detail in Table I. The wire costs include an allowance of 10 cents per 100 pounds for freight, which represents car-load lots hauled a considerable distance; in the case of iron wire freight is generally allowed in the quoted market price. The costs include only the line wire, insulators, pins, tie-wires, labor and accessories, excluding pole-line costs in every case. For the purposes of comparison the pole-line costs can be eliminated without substantial effect on the results, in the present case.

TABLE I.—COST DATA FOR WIRE CONSTRUCTION.

	Copper H. D.	47% Copper Clad	40% Copper Clad	Galv. Iron B. B.
Net cost per pound, No. *6	$0.1385	$0.1319	$0.1271	$0.0325
Net cost per pound, No. 7	.1385	.1319	.1271	.0325
Net cost per pound, No. 8	.1385	.1319	.1271	.0325
Net cost per pound, No. 9	.1398	.1331	.1283	.0325
Net cost per pound, No. 10	.1398	.1331	.1283	.03375
Net cost per pound, No. 11	.1410	.1343	.1295	.03375
Net cost per pound, No. 12	.1410	.1343	.1295	.0350
Net cost per pound, No. 13	.1435	.1368	.1319	.0375
Net cost per pound, No. 14	.1435	.1368	.1319	.0400
Net salvage per pound, all sizes	$ .1100	$ .045	$ .035	None
Labor, inslators, pins, tie-wires and sleeves required in erecting one mile of wire	$8.54	$8.54	$8.54	$8.43
Cost of taking down old wire at time of reconstruction, per mile	$2.00	$2.00	$2.00	$1.00

*B. & S. gauge for copper and copper clad, but B. W. G. for iron.

The first costs are then readily computed from the weights per mile. The total annual charges are next computed on a basis of 6 per cent interest, 1 per cent for taxes, 50-year life for copper and copper clad, 20-year life for iron, straight line depreciation without

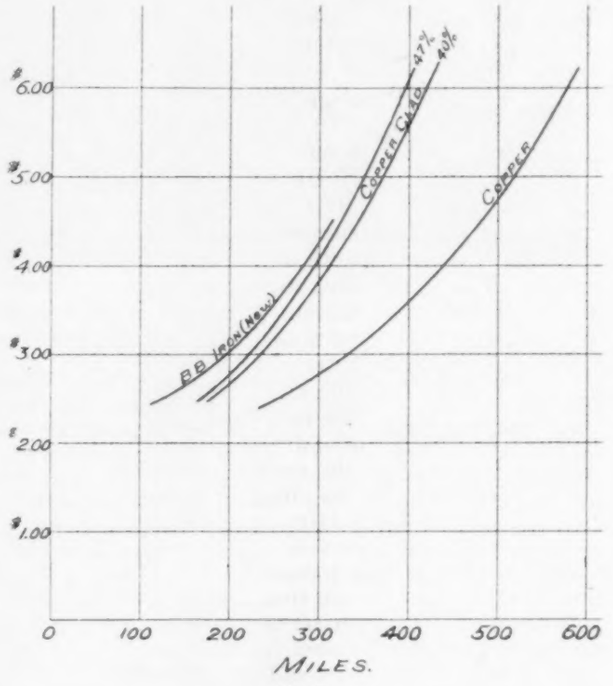


Fig. 3.

interest on the accumulated fund and $1.00 per mile per annum for maintenance. On this basis, with the costs given in Table I, the total first cost and the total annual charges, per mile, are given in Tables II, III, IV, and V, together with the resistance per mile, the

operative limit for simplex transmission and the breaking weight, for each kind of wire.

TABLE II.—COMPARATIVE COST AND OPERATING DATA FOR HARD DRAWN COPPER WIRE.

Size B. & S.	First Cost	Annual Charge	Ohmic Resistance	Operative Limit	Breaking Weight
No. 6	$66.71	$6.12	2.13	585	1,237
No. 7	54.66	5.23	2.69	535	980
No. 8	45.10	4.52	3.39	485	778
No. 9	37.75	3.98	4.28	437	617
No. 10	31.74	3.53	5.39	395	489
No. 11	27.15	3.19	6.78	357	388
No. 12	23.20	2.90	8.61	321	307
No. 13	20.42	2.70	10.81	289	244
No. 14	17.95	2.51	13.64	260	193

TABLE III.—COMPARATIVE COST AND OPERATING DATA FOR 47% HARD DRAWN COPPER CLAD STEEL WIRE.

Size B. & S.	First Cost	Annual Charge	Ohmic Resistance	Operative Limit	Breaking Weight
No. 6	$60.51	$6.14	4.54	426	1,800
No. 7	49.70	5.23	5.74	384	1,450
No. 8	41.12	4.52	7.25	346	1,200
No. 9	34.63	3.98	9.14	311	975
No. 10	29.30	3.54	11.47	280	800
No. 11	25.06	3.18	14.55	252	650
No. 12	21.70	2.91	18.27	227	510
No. 13	19.21	2.69	22.94	204	410
No. 14	17.02	2.51	28.88	182	330

TABLE IV.—COMPARATIVE COST AND OPERATING DATA FOR 40% HARD DRAWN COPPER CLAD STEEL WIRE.

Size B. & S.	First Cost	Annual Charge	Ohmic Resistance	Operative Limit	Breaking Weight
No. 6	$58.11	$6.00	5.32	397	1,800
No. 7	47.81	5.13	6.72	358	1,450
No. 8	39.68	4.44	8.47	322	1,200
No. 9	33.43	3.91	10.70	290	975
No. 10	28.30	3.48	13.47	261	800
No. 11	24.34	3.14	17.00	235	650
No. 12	21.10	2.87	21.40	211	510
No. 13	18.70	2.67	26.94	188	410
No. 14	16.59	2.49	34.02	169	330

TABLE V.—COMPARATIVE COST AND OPERATING DATA FOR GALVANIZED B. B. IRON WIRE.

Size B. W. G.,	First Cost	Annual Charge	Ohmic Resistance	Operative Limit	Breaking Weight
No. 6	$27.61	$4.36	9.49	306	1,890
No. 7	23.48	3.87	12.10	274	1,485
No. 8	21.11	3.58	14.36	253	1,250
No. 9	18.64	3.29	17.84	229	1,000
No. 10	17.14	3.11	21.71	209	825
No. 11	15.38	2.90	27.19	187	660
No. 12	14.38	2.78	32.94	172	545
No. 13	13.27	2.64	43.40	150	413
No. 14	12.39	2.54	56.56	...	317

These tables illustrate how rapidly the cost per mile increases with the total length of the line. The annual charges and the operative limits for simplex transmission are platted in Fig. 3, which brings out very forcibly this rapid increase in cost. It is interesting to note that the highest price material, copper, is the cheapest of all so long as the size required is mechanically safe in spans. Second and third in order come 47 per cent copper clad and 40 per cent copper clad, respectively, while iron is the least economical of all. As regards bare E. B. B. iron and steel telegraph wire, both are more expensive on the basis of annual charges than B. B. iron and hence will not be considered.

On a basis of first cost, iron is the cheapest material of all and then in the order of advancing cost come 40 per cent copper clad, 47 per cent copper clad and copper. It is highly noteworthy that this basis of comparison exactly reverses the order which is obtained on a basis of annual charges, and it serves to illustrate the fact that first cost considered alone is very misleading as to final economy in long continued service. First cost will naturally play its most significant part in the case of short period or temporary service, while annual charges are the true guide in permanent service.

While the annual charges per mile are very significant, it is even more significant to find the product of the charge per mile and the operative limit in miles, which is the total wire cost for service. The length and conductivity of the line wire determine another element of cost which ought to be considered here—namely, the expense for current or energy needed in the transmission of signals. Since the standard operating current is 50 milliamperes, the voltage needed will be proportional to the total resistance of the line wire, and the energy will be proportional to the voltage. The cost of the energy will depend greatly upon the character of the source. Primary batteries are more expensive than a power plant except in the case

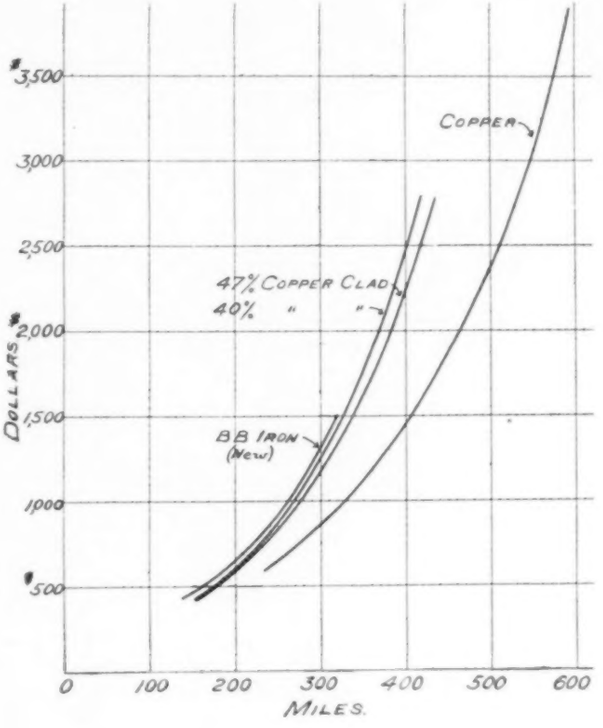


Fig. 4.

of small installations isolated from a reliable source of primary power. But for installations of fair size situated within reach of electric power mains, the primary battery becomes inferior in economy to a power plant consisting of motor generators or dynamotors, and perhaps a storage battery. Assuming the use of a power plant, it will be proper to take the cost of energy at 20 cents per volt, per line, per annum; this includes the fixed charges on the plant and the cost of operation, and is, of course, an average figure.

These elements of cost comprise everything except the charges on the pole line and the terminal plant, and the traffic and general expenses, with which we are not concerned at present. Computing the line-wire and energy costs for each of the four cases heretofore considered, gives the results shown in Tables VI, VII, VIII and IX.

TABLE VI:—ANNUAL LINE WIRE AND BATTERY CHARGES FOR SIMPLEX SERVICE OVER HARD DRAWN COPPER.

Size B. & S.	Operative Limit	Total Resistance	Annual Wire Charges	Annual Current Charges	Total Annual Charges
No. 6	585	1,246	$3,580	$12	$3,592
No. 7	585	2,439	2,798	14	2,812
No. 8	485	1,644	2,192	16	2,208
No. 9	437	1,870	1,739	19	1,758
No. 10	395	2,129	1,394	21	1,415
No. 11	357	2,420	1,139	24	1,163
No. 12	321	2,764	931	28	959
No. 13	289	3,124	780	31	811
No. 14	260	3,546	653	35	688

TABLE VII:—ANNUAL LINE WIRE AND BATTERY CHARGES FOR SERVICE OVER 47% COPPER CLAD STEEL.

Size B. & S.	Operative Limit	Total Resistance	Annual Wire Charges	Annual Current Charges	Total Annual Charges
No. 6	426	1,934	$2,616	$19	$2,635
No. 7	384	2,204	2,008	22	2,030
No. 8	346	2,509	1,564	25	1,589
No. 9	311	2,843	1,238	28	1,266
No. 10	280	3,212	991	32	1,023
No. 11	252	3,667	801	37	838
No. 12	227	4,147	661	41	702
No. 13	204	4,680	549	47	596
No. 14	182	5,256	457	53	510

TABLE VIII:—ANNUAL LINE WIRE AND BATTERY CHARGES FOR SERVICE OVER 40% COPPER CLAD STEEL.

Size B. & S.	Operative Limit	Total Resistance	Annual Wire Charges	Annual Current Charges	Total Annual Charges
No. 6	497	2,112	$2,382	$21	$2,403
No. 7	358	2,406	1,837	24	1,861
No. 8	322	2,727	1,430	27	1,457
No. 9	290	3,103	1,134	31	1,165
No. 10	261	3,516	908	35	943
No. 11	235	3,995	738	40	778
No. 12	211	4,515	606	45	651
No. 13	188	5,065	502	51	553
No. 14	169	5,749	421	57	478

TABLE IX:—ANNUAL LINE WIRE AND BATTERY CHARGES FOR SERVICE OVER B. B. GALVANIZED IRON.

Size B. & S.	Operative Limit	Total Resistance	Annual Wire Charges	Annual Current Charges	Total Annual Charges
No. 6	306	2,904	$1,334	$29	$1,363
No. 7	274	3,315	1,060	33	1,093
No. 8	253	3,633	906	36	942
No. 9	229	4,085	753	41	794
No. 10	209	4,537	650	45	695
No. 11	187	5,085	542	51	593
No. 12	172	5,666	478	57	535
No. 13	150	6,510	396	65	461
No. 14	...	....	.....	...	.....

These tables show how rapidly the total cost increases with the length of the line or the distance over which service is desired. They also exhibit the interesting fact that as the distances increase less energy is required for transmission, because the total line resistance decreases. Of course this assumes that the line conductor in every case is no larger than that theoretically needed from the single standpoint of conductivity. The total annual charges are platted in Fig. 4, which shows that on the basis of conductivity alone copper is the most economical material of all and then in order come 47 per cent copper clad, 40 per cent copper clad and B. B. iron. The figures and the curve for iron assume, of course, that it is new; the corrosion which appears with age decreases both the conductivity and the tensile strength, and the wire becomes less efficient and less economical. If this result is anticipated by the provision initially of some excess in conductivity and tensile strength, the annual charges are correspondingly increased.

When wires are suspended singly in overhead spans, conductivity, while no less important than before, is not the sole consideration. Tensile strength becomes equally important and sometimes the governing factor. This is particularly true of copper wires. The various wire companies have gradually increased their standards of tensile strength, as the result of experience with small conductors. The minimum safe tensile strength is fixed by a number of considerations, prominent in which are the most severe probable loads of wind and sleet, and the length and sag of the span initially. But fundamentally we are first concerned with the important question of the reliability of service, as to whether we require absolutely continuous service, or whether occasional interuptions will be permissible. As a matter of fact the majority of wire companies giving telephone and telegraph service are subject to occasional interuptions, but not frequently. These occur as a rule in sleet storms of more than average severity. The excessive cost of absolutely continuous service is the greatest barier in the way of its realization commercially, referring here, of course, to aerial construction. Hard drawn copper wires even as large as No. 8 B. W. G. (435 pounds per mile), fail at long intervals.

The largest telegraph companies and many of the railroads have now arrived at a standard minimum size of copper for trunk line service weighing 209 pounds per mile, or No. 9 B. & S. gauge. The choice of this minimum standard size, based on mechanical requirements, has a most important bearing

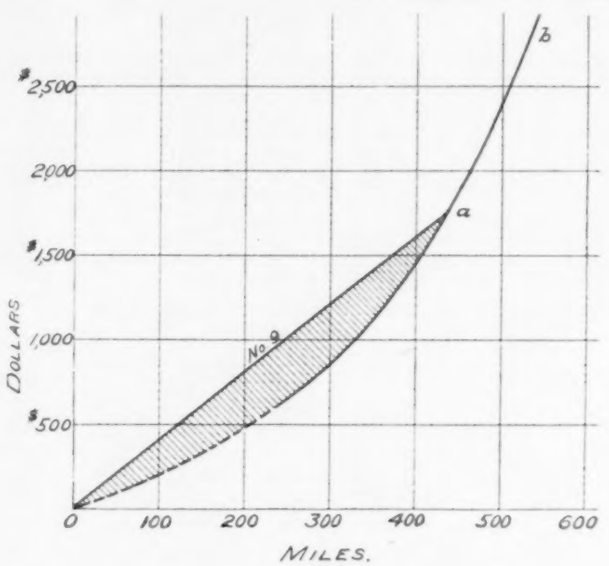


Fig. 5.

on plant economy. Fig. 5 shows the curve of total annual cost for service with hard drawn copper wire, over various distances, taken from Fig. 4. If No, 9 B. & S. is adopted as the minimum safe size, it means that No. 9 will be used for all distances less than 437 miles,—assuming through simplex (single) working.

The practical effect of this choice of a standard will be to alter the annual charges for service for all distances, less than 437 miles. The portion *a b* of the curve in Fig. 5 will remain as before ,but between *a* and the origin a straight line will take the place of the curve. This straight line is everywhere above the curve, and shows therefore that the costs have been increased. This is obviously true because a conductor smaller than No. 9 would suffice from the single standpoint of conductivity. The shaded area enclosed between the curve and the straight line shows, therefore, the cost of securing the necessary tensile strength. This extra cost is entirely wasted so far as conductivity is concerned, because it represents an excess over the actual requirements.

In one sense this shaded area represents an economic waste, because there is an unused margin of conductivity. It is quite evident that a staisfactory conductor of higher tensile strength and lower conductivity than copper will find an economic field of use in this service. Before the introduction of copper clad steel some five years ago, iron and steel were the only satisfactory materials to substitute for copper where high conductivity was not essential. Fig. 6 shows that the modified curve for copper (from Fig. 5) crosses the curve for iron at the point *c* and that new iron is therefore the less expensive material for distances less than 280 miles. Taking the tensile strength of No. 9 copper as 617 pounds, it will be found that iron can be used in sizes as small as No. 11, B. W. G. without going below that degree of strength. The practical difficulty with iron and steel is the comparatively short life due to corrosion, and the accompanying loss of conductivity and strength. When this objection is overcome by providing initially a proper margin of conductivity and strength, or excess metal in the wire, the costs are increased at the same time and iron ceases to be more economical than copper. This would appear in Fig. 6 as an upward shifting of the curve for iron, so that it would lie wholly above the curve for copper.

The copper curve in Fig. 6 intersects the curve for 47 per cent copper clad at about 310 miles (*a*), and the curve for 40 per cent copper clad at about 293 miles (*b*), so that for shorter distances than these copper clad is the more economical material. While

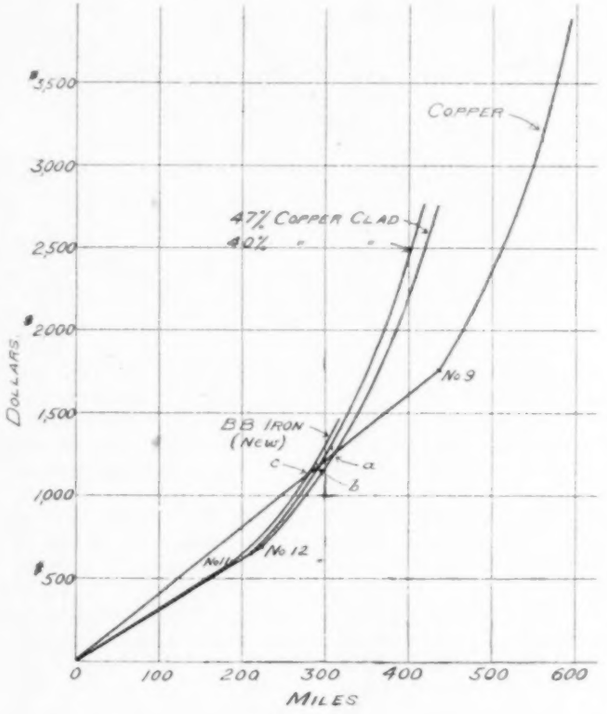


Fig. 6.

the tensile strength of No. 12 B. & S. copper clad is somewhat less than the strength of No. 9 copper, its superior elastic limit places it on a nequal footing; so that it can be used in sizes as small as No. 12 without reducing the safe load below that which is permissible with No. 9 copper, under like conditions. The tension, torsion, bending, hammering and quenching tests on copper clad establish the existence of a weld between the metals, and the microscope discloses the existence of a thin film of copper-iron al-

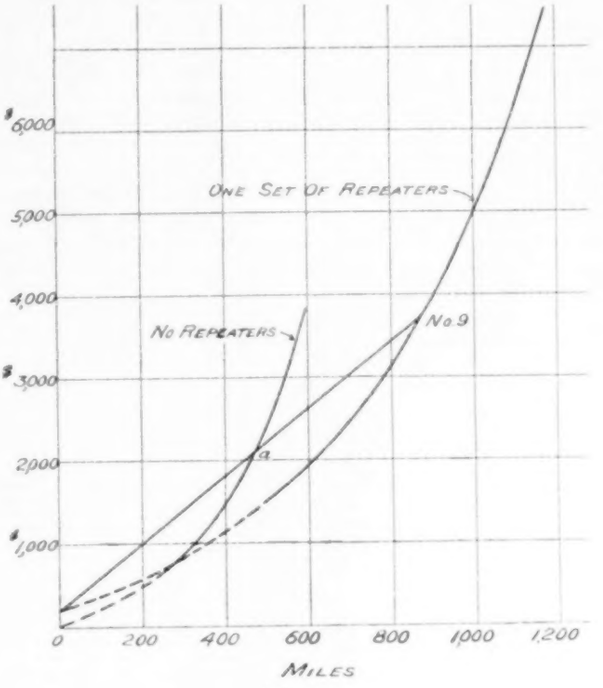


Fig. 7.

loys in the weld area. No corrosion is to be feared except at the ends and there it has been found that a protective coating forms in a short time which arrests any further action as long as the coating remains intact.

Fortunately for the commercial success of long-distance telegraphy it is possible to introduce automatic repeaters in long circuits and thus avoid the use of very large and expensive conductors, which otherwise would be necessary. This makes it possible to operate comparatively small wires at high speed over very great distances. But the so-called automatic repeaters are not automatic in the full sense. When once adjusted for a given set of line conditions they will operate almost indefinitely, without further attention, until the conditions undergo some change. Such changes occur rather frequently, of course, principally on account of changes in weather conditions. In other words, automatic repeaters require supervision to keep them in working adjustment. A single set of repeaters does not require the whole of one attendant's time, and he can care for a number of sets. The number varies according to the standard of service quality which it is intended to maintain. In leased wire service it is sometimes customary to assign six repeater sets to each supervisor, which probably represents the highest commercial standard which it is attempted to maintain. In other cases the supervisor may have twice as many sets.

The principal expense for repeater service is supervision. Of course, there is a small charge for the floor space required and a small charge to cover the

interest, depreciation, etc., on the repeater equipment. If we assume that a repeater supervisor is paid $90 per month and that he cares for six sets, the annual labor charge is $180 per set or per through circuit. If we add $20 per annum to cover the other items, making a total of $200, the last figure will represent a maximum outlay for the highest quality of service.

The method of finding the economical spacing will be similar in general to the procedure followed in comparing different conductor materials. That is, the problem will be solved first on a basis of conductivity, alone, and then modified to fit the requirements of tensile strength. We shall consider first the case of one set of repeaters at the center of the line, with copper conductors. Doubling the operative limits given in Table VI, and also doubling the total annual charges and adding $200, we get the results shown in Table X.

TABLE X:—ANNUAL LINE WIRE AND BATTERY CHARGES FOR SIMPLEX SERVICE OVER HARD DRAWN COPPER, WITH ONE SET OF REPEATERS AT THE CENTER OF THE LINE.

Size B. & S.	Operative Limit	Total Annual Charges
No. 6	1,170	$7,384
No. 7	1,070	5,824
No. 8	970	4,616
No. 9	874	3,716
No. 10	790	3,030
No. 11	714	2,526
No. 12	642	2,118
No. 13	578	1,822
No. 14	520	1,576

Table X shows the cost of service over copper wires when there is one set of repeaters at the center of the line. These values and the values in Table VI are plotted for comparison in Fig. 7. The curve of cost for the line with one set of repeaters is extrapolated below the size of No. 14 B. & S., because that is the smallest commercial size of bare hard drawn line wire. The curves show that for distances in excess of about 300 miles, the use of one set of repeaters is theoretically more economical than a direct circuit. A 300-mile circuit with one set of repeaters—that is, two 150-mile lines in tandem through a repeater—would require only the conductivity of a No. 19 B. & S. copper wire, which is operative for 150 miles.

A similar comparison for 47 per cent copper clad is carried out in Table XI and the results, together with the figures from Table VII, are plotted in Fig. 8.

TABLE XI:—ANNUAL LINE WIRE AND BATTERY CHARGES FOR SIMPLEX SERVICE OVER HARD DRAWN 47% COPPER CLAD, WITH ONE SET OF REPEATERS AT THE CENTER OF THE LINE.

Size B. & S.	Operative Limit	Total Annual Charges
No. 6	852	$5,470
No. 7	768	4,260
No. 8	692	3,378
No. 9	622	2,732
No. 10	560	2,246
No. 11	504	1,876
No. 12	454	1,604
No. 13	408	1,392
No. 14	364	1,220

Fig. 8 shows that for lines of 47 per cent copper clad exceeding 250 miles in length, approximately, it is less expensive to use a single set of repeaters at the center of the line, and consequently a smaller line wire. but in this case and the one preceding it, the conductivity needed for the shortest economical line with repeaters results in a conductor of inadequate strength.

Returning to Fig. 7, and bearing in mind that No. 9 copper is the smallest safe size, it will be observed that this assumption (represented by the straight line in the figure) changes the case materially. The intersection at *a* in the figure shows that when the line exceeds 470 miles in length, it becomes economical to employ repeaters. The same consideration in Fig. 8 shows that when the line of copper clad exceeds 290 miles in length it pays to change from a through circuit to two circuits in tandem through a repeater set. The limits of 470 miles and 290 miles for copper and copper clad, respectively, take into account both tensile strength and conductivity, and are therefore commercially applicable.

It was previously shown for non-repeated circuits that copper clad in comparison with copper is more economical for lines less than 310 miles in length. The next question is how the comparative economy is affected by the use of repeaters in longer circuits. This is shown in Fig. 9, which compares No. 9 copper and No. 12 copper clad (47 per cent) for distances up to 1,500 miles. The number of repeater sets is shown on each curve in the figure. Even with the rather high cost of repeater supervision here assumed, it is clear

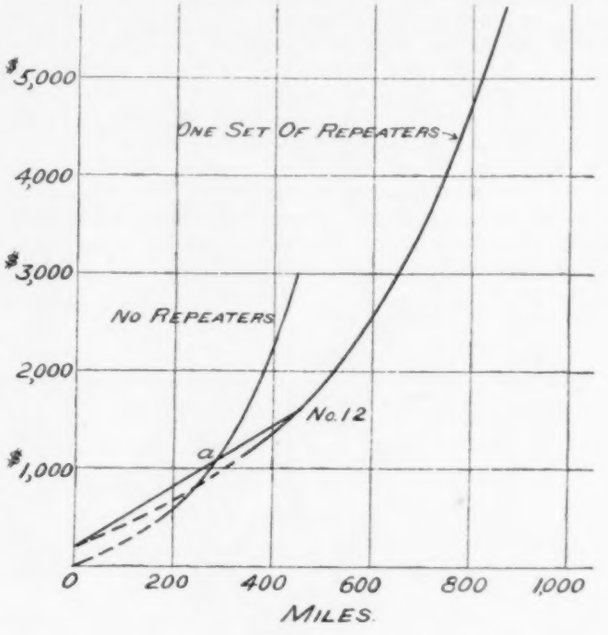


Fig. 8.

that No. 12 copper clad with repeaters is more economical than No. 9 copper, up to the limit of the permissible number of sets. At 600 miles the annual saving of copper clad is $260; at 1,000 miles it is $540, and at 1,500 miles it is $790 per annum. No. 11 and No. 10 copper clad are also more economical than No. 9 copper, while No. 9 copper clad is a trifle more expensive but at the same time offers more than 50 per cent additional strength.

The economical limit of copper clad is apparently fixed by the maximum permissible number of repeater sets, from an operating standpoint. This in its turn is affected by a number of considerations. Of course transcontinental quad circuits are in daily operation with five sets of repeaters, from New York to San Francisco. In Canada a Montreal-Vancouver duplex circuit, of about equal length, is operated with two sets of repeaters. Under average conditions in the middle states, repeater stations are not over 500 miles apart on No. 9 copper circuits. If five sets are permissible, it is then economical to use No. 12 copper clad up to

distances of about 1,400 miles and No. 10 copper clad up to 1,700 miles.

The difficulties of keeping such a repeater lay-out in good working adjustment for fast service increase with the number of repeater sets, and delays are likely to be quite frequent unless the supervision is of the best. We have assumed a high grade of supervision, however, in every case, by giving the supervisor a minimum load. It is essential for the supervisor to watch his circuits constantly and detect approaching trouble before it arrives. By this kind of vigilance a long circuit can be kept in almost continuous service through changing weather of any kind.

The proposition to halve the average interval between existing repeater offices, or to cut it from about 500 miles to 250 miles, is another factor in the problem. There may or may not be available offices with suitable facilities, and so situated as to become the natural repeating point for a fair sized group of long-haul circuits. It need hardly be pointed out that the

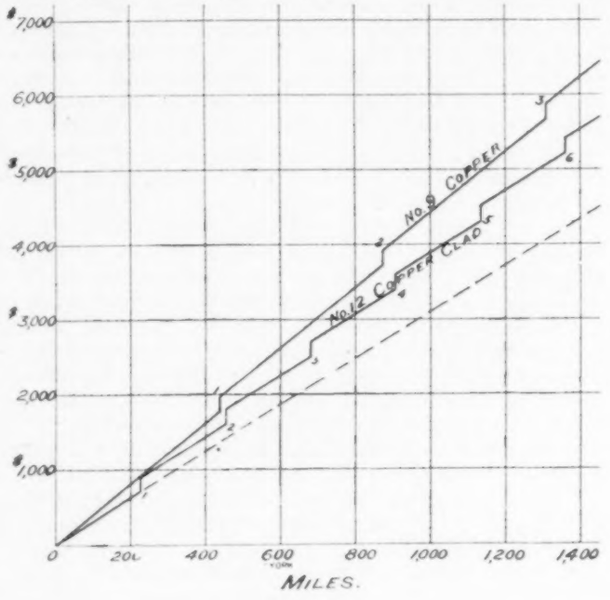


Fig. 9.

theoretically correct location for a set of repeaters can not always be the actual location, because repeater sets which would be located theoretically within a given district must be grouped in a single office so as to secure economy of supervision and power supply. Considering the fact that the shortest theoretical interval between repeater sets, using copper clad conductors, is 145 miles (see Fig. 8), and observing at the same time that in the greater portion of the United States cities and towns large enough to become favorable locations for repeater stations occur at even shorter intervals, there is apparently no physical difficulty to be met. In the case of trunk line railroads, the lower limit of 145 miles fits in very well with the length of an operating division, except in the thinly populated western country.

Another phase of the problem is the labor question and at this point, perhaps, one of the most valid objections to the increase in the number of repeater stations can be raised. Obviously the general increase in repeater offices requires an increase in skilled labor for the purposes of supervision, and perhaps a slight increase in the maintenance force. Notwithstanding that the plant economy justifies it, the multiplication of labor is a question to be considered seriously. Telegraph operators of more than average ability are not in plentiful supply at all times, and it requires time to train green men for work of this class. Offsetting this objection, however, is the fact that the increase in labor will not be anything approaching a large percentage of the average force of operators and wire chiefs now employed. Assuming the addition of one man for six through circuits, which require at least twelve operators, the increase is only 8 per cent, for one repeater office; this applies to simplex circuits from 300 to 500 miles in length. The longer circuits are usually duplexed or quadruplexed. A 1,000-mile circuit, for example, quadruplexed, would now require eight operators and one repeater set, and also some terminal supervision of the quad sets. The addition of two repeater offices, or the equivalent of one-third of one man, would result in an increase of labor of only 4 per cent at the most.

These increases in labor can scarcely be regarded as very serious. The plant economy fully justifies them, even under the assumption that the highest quality of service must be maintained. Of course there is some natural aversion to increasing the number of repeaters, which arises in the main from arguments already covered. But the final economy which results from the study of the subject here presented seems to indicate that the plan is proved in, up to the point where the number of repeater sets is limited by considerations of facility in operation.

Great Northern Extends Telephone Service

The Great Northern Railway, which already has nearly 4,000 miles of track equipped with telephone train dispatching equipment, has just placed an order with the Western Electric Company for thirty-two telephone selectors to equip its Cascade division.

The circuit will be divided into two sections. The first will extend from Tye, Washington, to Everett Junction, Washington, with a branch from Monroe, Washington, to Tolt, Washington, and another from Pacific avenue to Delta, Washington. The second section will run from Tye to Leavenworth, Washington. The distance covered by the first section will be 93 miles, while that covered by the second will be 36 miles. The dispatcher for both circuits will be located at Tye.

The Toledo and Ohio Central Railroad has ordered forty-eight Western Electric telephone selector equipments for use on its Eastern division. There will be two circuits equipped, one extending from Bucyrus to Toledo, a distance of seventy miles, and the other from Bucyrus to Thurston, a distance of seventy-eight miles. The telephone messages will be sent over a line wire of No. 9 B. & S. copper, and the dispatchers for both circuits will be located at Bucyrus.

The Nickel Plate has recently ordered of the Western Electric Company a complete telephone train dispatching circuit, consisting of 31 Western Electric selectors and the necessary telephone equipment, to equip its Buffalo division. This circuit will be 116 miles in length, and will extend from Buffalo, New York to Conneaut, Ohio. The train dispatcher will be located at Conneaut.

Observations on Telephone Transmission

By J. L. McQuarrie*

THE problem of furnishing telephone transmission between two points is physically similar to the problems involved in the electrical transmission of power, in that there is in each case a station for the generating of electrical energy, a station to which it is desired to transmit this electrical energy for the operation of apparatus, and a transmission line connecting the two stations. From an engineering standpoint, however, the problem is dissimilar in that in the case of telephone transmission the amount of energy is very small compared with that involved in the case of power transmission, and in that the allowable expenditures for the apparatus and line in the two cases are based on fundamentally different considerations. Just as, however, in the case of power engineering, it is possible to balance accurately the relative costs of the power apparatus at the generating and receiving stations against the cost of the line and the energy losses, so, in telephone engineering, it is possible to balance the costs of different methods of furnishing a desired grade of telephone transmission to all telephone stations within a given system, which it is desired to interconnect. From a physical standpoint the matter is much more complicated, but from an engineering standpoint, given the correct premises, the problem permits of as accurate and definite a solution.

It is not proposed in this paper to enter deeply into telephone engineering, to the extent of discussing methods of securing adequate grades of transmission between all the stations within a given area at the minimum total cost for equipment and operating expense, but rather to point out some of the steps of progress which have been made in the direction of improving the means of supplying telephone transmission and then to indicate in a general way some of the fundamental principles which underlie the engineering features of the subject.

PROBLEMS OF TRANSMISSION.

Since the beginning of the industry telephone engineers and inventors have been confronted by two problems with respect to transmission: First, to increase the possible range of communication, that is, the distance over which it is possible to provide a satisfactory grade of telephone conversation; and, second, to cheapen the methods or means of furnishing this transmission.

The reason for development along each of these lines is at once obvious. The range of telephone transmission can be extended either by increasing the efficiency of the instruments employed, or by increasing the efficiency of the line. The cost of providing telephone facilities can be reduced either by improving the instruments or by cheapening the line while maintaining a given standard of efficiency, since for a given grade of transmission with improved telephone instruments, a cheaper type of line is possible. This, by the way, illustrates one difference between the telephone engineer's and the power engineer's problem. As a general rule, an increase in efficiency of the generating or receiving station apparatus would not justify the power engineer in decreasing his line efficiency, at least to any marked extent.

The success which has attended the effects of telephone engineers is attested by the fact that, while at the outset it was possible to communicate only between rooms within a building, commercial service is now being given between New York and Denver, and the limit of such service has not yet been reached.

THE INSTRUMENTS USED.

The magneto telephone designed by Bell, while possessing the essential elements of the modern instrument, was necessarily crude and inefficient. Improvements were made soon after Bell's invention was announced, which resulted in the design of the well known "hand telephone." This instrument served for more than a year as both receiver and transmitter, but it was quite early appreciated that, in order to extend the sphere of usefulness of the telephone, more powerful apparatus should be employed.

The early investigators had observed that the hand telephone was very sensitive to minute electrical changes, but they felt that a more efficient transmitter would be required. The suggestion had been made in the beginning that the transmitter be arranged to alter the resistance of a circuit, including a battery, in conformity to the variations of the sound waves; in fact, Bell's patent disclosed a plan for this purpose and Gray also suggested a form of battery transmitter in his early patent application. It remained for Hughes, however, to point the way to secure the desired result by the employment of a microphone contact device, and Edison soon followed with the soft carbon button. Berliner then added a commercial touch to the art by proposing that an induction coil be used in the transmitter circuit. The first battery transmitter employed to any extent in the United States was the Edison instrument, which was soon followed by the Blake. Both of these transmitters were extensively employed in the early days.

As the demand developed for communication over increasingly greater distances, still further efforts were made to improve the transmitter and the suggestion was offered by Hunnings that granular carbon be employed for the current changing medium. This proposal took commercial form in the so-called "long distance" transmitter first employed by the Bell Company in 1886. An improved type of granular carbon instrument was introduced four years later, known as the "solid back" transmitter, and this is the standard transmitter at the present time. The solid back transmitter is approximately 70 per cent more efficient than the Blake.

Various modified forms of the "solid back" transmitter have appeared on the market within recent years, embodying different methods of constructing the button and proportioning the working parts, but these instruments are essentially the same as the type which was originally produced by the engineers of the

*A paper read before the Railway Superintendents of Telegraph at the convention held in Boston June 26 to 30.

American Bell Telephone Company and the Western Electric Company.

The receiver in its early form proved to be a remarkably sensitive instrument and it was therefore not susceptible to the same degree of improvement as the transmitter. Many varieties of receivers were constructed at the outset, the variation consisting principally of different arrangements of the magnets, but the form of the old hand telephone persisted so that the present standard instrument closely resembles the early type. It is about 15 per cent, or perhaps two miles of standard cable, more efficient, however, because of the employment of an improved magnetic circuit.

Very loud speaking transmitters have been exploited by inventors from time to time. Loud speaking receivers have also been produced which are capable of being used satisfactorily without being placed to the ear. Such instruments have not been found useful for regular commercial service, although they have been employed in some special cases. An equipment of loud speaking receivers is now being tested by one of the large railroads for tower service in connection with a train dispatching circuit.

One of the most interesting problems concerning telephone transmission is that of the repeater. The demand for an instrument which would relay the voice currents was very early appreciated, and much thought and labor have been devoted to this subject. The problem of the repeater consists really of two problems; first, a device for amplifying weak telephone currents without distorting them; secondly, an arrangement of circuits which will permit repeating both ways without switching. A repeater which accomplishes both of these objects has been employed on the long lines of the American Telephone and Telegraph Company for about six years. This repeater is capable of extending the range of transmission by 40 per cent, which means in terms of 210-pound copper circuit an increase in talking distance of about 250 miles.

The instruments which are employed for telephone transmission must of necessity be of a somewhat delicate nature because the energy with which they deal is of small magnitude. This, coupled with the fact that they are subjected to severe treatment in service, makes it essential that they be of substantial design, and that they be manufactured with great care. Uniformity in the product is also a very important factor and these requirements are best realized under conditions which provide for the attention of trained experts of long experience.

FEATURES OF TELEPHONE LINES.

The foregoing deals with the instruments. The lines which form a very important part of the telephone equipment will next be considered.

It was to be expected that the first telephone lines should be similar to the then existing telegraph lines. Iron wire and grounded circuits constituted the early practice, and many years elapsed before proper attention was devoted to the lines to adapt them to the peculiar requirements of telephone service.

The first important improvement in the line plant consisted of the introduction of metallic circuits. This change was a measure of necessity to prevent disturbances caused by other electric circuits, as well as to avoid objectionable cross-talk between adjacent telephone lines.

The next improvement of importance in the line plant affecting transmission was the employment of hard drawn copper wire in place of iron. The limitations of iron wire were appreciated as soon as efforts were made to extend the range of transimssion and, while copper had previously been used for electric circuits, it was not suitable for aerial lines because it was too soft. T. B. Doolittle, an engineer in the employ of the American Bell Telephone Company, developed a process for manufacturing hard drawn copper wire, and this was the first important step toward the realization of long distance telephony.

As the business grew, and the demands for service increased, the congestion of overhead wires in cities led to the employment of cables. At first, as in the case of open wire lines, telephone cables were similar to the then existing telegraph cables. It was soon discovered, however, that owing to crosstalk or overhearing between adjacent conductors, it was not possible to extensively employ grounded telephone lines in cables, and metallic lines, with the two conductors twisted together, were found to be necessary. Practically the only satisfactory telegraph cable at that time was the one insulated with gutta percha. As this was very expensive and also, because of its high capacity, very inefficient, the problem confronting the telephone engineer at that time was the development of a satisfactory telephone cable. A large number of designs of cable were experimented with but the final type which is now used under all conditions excepting the most severe submarine service, is the dry core paper-insulated lead-covered cable, which it is not necessary for me to describe.

Following the development of the hard drawn copper wire, and of the dry core paper cable, some years later an invention was perfected which provided a means for not only extending the limit of telephone transmission but also for effecting economies in the construction of the lines. Especially in the case of cables the economies are so great as to permit of the use of underground cables between points which, without this means, it would be practically impossible to connect by cables. This is of great practical advantage since overhead lines are notably subject to trouble from storms, while cables are free from such troubles. The invention to which I refer is the use of loading coils in the lines. This invention, more than any of the preceding improvements, marked the application of scientific principles to the problems of telephone transmission.

In the early records of tests on telephone transmission through cables are to be found statements to the effect that the transmission over cable circuits is equally as good as that over open wire circuits. As the length of cable was increased, however, it was soon found that this was not the case and that telephone transmission was reduced very much more by passage through cables than over a corresponding length of open wire line employing the same gauge of copper conductor. It was quite early recognized that, since the cable had very much larger mutual capacity than the open wire line, telephone transmission must be poorer over the cable. This conclusion developed from the scientific work performed by the late Lord Kelvin in connection with submarine telegraph circuits. What was not realized, however, for many years, was the fact that in the case of open wire lines there was present to a considerable degree what may be termed, from the point of view of the telephone

engineer rather than from a purely physical standpoint, a "corrective element," namely, the self-inductance of the line. In the case of cables, due to the fact that the two wires are very close together corresponding to the non-inductive winding of a resistance coil which is so familiar to you all, the self-inductance of the circuit is a minimum. In case of the open wire line, the wires being 12 inches or more apart, the self-inductance has a comparatively large magnitude and is of great importance in telephone transmission. For instance, in the case of a No. 8, B. W. G. copper circuit, which has a conductor weighing about 435 pounds per mile, the range of commercial transmission between stations equipped with standard instruments is about 1,000 miles. If we could conceive of the wires being left 12 inches apart so that the capacity would be the same as at present but in some mysterious manner the self-inductance of the circuit would be obliterated, the commercial range of transmission over this circuit would be reduced to perhaps 350 miles. I present this as an illustration of the importance of self-inductance in telephone circuits. Of course, if we could by some means avoid the capacity in a telephone circuit, we would prefer not to have the self-inductance present. If, however, the capacity is to be present, to obtain an efficient telephone circuit, a comparatively large amount of self-inductance should also be present.

It was pointed out that to improve the transmission over open wire lines, the self-inductance that was present should be substantially increased and that over cables where the amount of self-inductance was almost negligible, it should be still further augmented in order to obtain the best results, and it was suggested that one method of increasing the inductance of the circuit would be to insert at intervals self-inductance coils, one winding in each of the two wires of a metallic circuit, or else a separate coil in each wire. No one, however, seemingly was able to show the telephone engineer how to introduce these coils into the lines.

LOADING WITH SELF-INDUCTANCE.

Professor Pupin, by mathematical investigation, checked by experiments, about ten years ago furnished the telephone engineer with a practical plan for the employment of self-inductance coils which came to be known as "loading coils," this designation being derived from the analogy of the telephone circuit, with a string loaded with weight at intervals. For the benefit of those who may be interested I will digress for a moment to amplify on this analogy. If a long string is fastened to a support at one end and the other end is moved quickly at right angles to its length, waves will pass along the string. If the string is sufficiently long, these waves will die out almost completely before reaching the fixed end. The distance which the waves will travel before being reduced to a given fraction of their original height or amplitude, will depend upon four factors, namely, upon the frequency or number of times per second the free end of the string is moved from one extreme position to the other and back, upon the frictional losses due to the stiffness of the string and to friction between the string and the air; upon the mass of the string per foot length; and upon the tension under which the string is held. It can be shown mathematically and also by simple experiments that if, instead of a uniform string of a given mass per foot, a very light string with such weights at uniform intervals as to give the same average mass per foot is employed, the waves along the string will start out with the same amplitude for a given movement of the free end of the string, and will die away at the same rate, provided the number of weights per wave length along the line is sufficiently great. Without pointing out the complete analogy between a motion of waves along a string and the telephone circuit, it may here be said that the telephone current is transmitted in the form of waves, and as these current waves progress along the conductor, they become altered in form as a result of counter influences inductively created by the current wave itself, and inasmuch as the loudness and clearness of transmission is determined by the accuracy of reproduction of the wave form, and by its amplitude or height, the effect of the action of these inductive influences is to impair the transmission efficiency of the circuit. In seeking a remedy in the case, the object to be obtained is to preserve the original form and amplitude of the wave as far as possible. In the case of the string, it is found that for a given frequency, tension and amount of frictional losses, the larger the mass per unit length the greater the distance a wave of a given amplitude will be transmitted before being reduced in height by a given amount.

The mass of the string corresponds to the self-inductance of the telephone circuit and just as the mass of the string can be increased by adding weights, a certain number per wave length, so the self-inductance of the line can be increased by adding masses of self-inductance that is, inductance or leading coils, a certain number per wave length.

In practice, therefore, small coils or copper wire, wound on iron cores, are connected in the telephone circuit at proper intervals and the effect of this on the current wave corresponds to the effect of the weights attached to the string, with the result that the form of the current wave at the receiving end of the line is comparatively unaltered, and its original height or amplitude is less reduced.

Loading has been very successfully employed on open wire lines and on underground and submarine cable circuits. An idea of the improvement in the transmission which results from the use of loading coils may be gained from the statement that where conditions favor loading, the 175-pound copper open wire circuit by loading is made equivalent in transmission efficiency to a 435-pound copper open wire unloaded circuit. In the case of cable, still greater relative gains in efficiency are possible; for example, a No. 19 B. & S. gauge cable suitably loaded has a higher telephonic efficiency than a No. 10 B. & S. gauge cable non-loaded. The No. 19 cable conductor weighs but one-eighth of the No. 10.

PHANTOM CIRCUITS.

Phantoming has been employed in the past to produce economy in the telephone plant, because the phantom circuit provides a means for obtaining an additional line from two existing lines. It is but recently, however, that advantage has been taken of the increased efficiency of the phantom circuit to extend the range of transmission. The New York-Denver line lately placed in service, and the Boston-Washington underground cable now being laid, are examples of the latest advances in this branch of the art. The

New York-Denver line is composed of a phantom of two pairs of 435-pound copper between New York and Chicago, a single pair of similar conductors between Chicago and Omaha, and another phantom of two pairs between Omaha and Denver. The really remarkable feature of this circuit is that the phantom itself is loaded. The transmission over this circuit is equivalent to that of 30 miles of standard No. 19 gauge cable. The Boston-Washington cable is composed of 14 pairs of No. 10 B. & S. gauge conductors laid up into 7 quads for phantom working, and 36 pairs of No. 13 B. & S. gauge conductors laid up into 18 quads for phantom working, with 6 pairs of No. 13 B. & S. gauge and 18 pairs of No. 16 B. & S. gauge conductors not laid up into quads. By the use of the phantom principle it has, in this instance, been possible to increase the number of telephone circuits through the cable by 25. In addition to this, the phantom circuits have a higher efficiency than the circuits in pairs of the same gauge. By means of this cable it will be possible to talk very satisfactorily from Boston to Washington over the No. 10 gauge phantom circuits. The smaller gauge circuits will be used for connecting the towns less remotely situated.

(To be continued.)

Use of Railroad Telephone Established

On nearly 50,000 miles of American railroad the use of the telegraph for train dispatching has been supplanted by the telephone. Practically all of the important trunk lines have taken up the new method to some extent and thirteen of them now use the telephone on more than 1,000 miles of road. These range from the Atchison, Topeka & Santa Fe, which has telephone equipment installed or under construction on train mesage circuits covering 7,000 miles, down to the Northern Pacific with nearly 1,200 miles. The list includes the Lake Shore & Michigan Southern; Pennsylvania lines east of Pittsburg; New York Central; Chicago, Burlington & Quincy; Big Four; Illinois Central; Canadian Pacific; Great Northern; Chicago, Milwaukee & St. Paul; Louisville & Nashville, and the Seaboard Air Line.

Among the other lines which have taken up the telephone is the Delaware, Lackawanna & Western which has given up its entire main line to this method of handling train movements. The development of the selector, a device which enables the dispatcher to call any station on a single line without bothering the others, has had a great deal to do with the popularity of the railway telephone.

The superintendent of telegraph of the Seaboard Air Line recently figured that the telephone has enabled his road to handle a traffic of 11 per cent greater density with an average saving of 5½ per cent as against the telegraph. According to this official, telephone operation has been found just as safe, reliable and efficient and very much quicker and more comprehensive than the telegraph.

The telephone apparatus, aside from the selector, used by railroad people has been especially developed to meet the severe conditions of the service. Telephone manufacturers have co-operated closely with the railroad officials in their work. One concern is reported to have expended over $100,000 in developing its railway telephone equipment and the work is not yet completed.

With the so-called loud-speaking receiver it is not necessary for one to hold the receiver to his ear in order to hear a conversation, for with this newly developed loud-speaking receiver located anywhere in the room within five or ten feet of the listener any message that comes from the dispatcher can be heard distinctly. This instrument is the latest and one of the most important contributions to art of railway telephony, for whenever it is installed both hands of the operator are left free to throw his switches or to write down his orders. The engineers were at work on this single piece of apparatus for more than two years before they got a satisfactory model.

There was not a delegate out of the seventy-five that attended the Boston convention who was not positive in the statement that the telephone would in a very few years largely, if not entirely, supplant the telegraph for use in connection with the handling of train movements.

It is an interesting fact that not a single railway accident has been traced to the substitution of the spoken orders for the dot and dash.

Long Distance Telephone in Spain

Consul Edward J. Norton, Malaga, Spain, says the local telephone system has recently been extended by the establishment of an exchange whereby Malaga is now connected with seven points within the kingdom, including Madrid. The long-distance service will be extended so as to give, within a few months, direct communication with 53 important cities, the project being conceived to take in points as far distant as Barcelona and San Sebastian.

Long-distance rates, for conversation of three minutes or fraction thereof, are 9 cents for 30 miles, 22 cents for 125 miles, 40 cents for 250 miles, and 75 cents for 500 miles. In connection with the above service a new system has also been inaugurated for the transmission of telephone messages. A 15-word message destined to any point without the province may be sent for 19 cents; to any point within the province of Malaga for 9 cents. These messages are received on blanks similar to those now in use for the telegraph service.

Telephones in Sweden

Consul Stuart J. Fuller, Gothenburg, Sweden, says a local daily newspaper calls attention to the increased telephone traffic between southern Sweden and northern Germany, and states that arrangements are being made by the German administrations to improve and extend the facilities of such traffic. The service to Germany has been available for about two years. From Gothenburg one can talk to points as far south as Berlin, with results that are usually good, although the weather sometimes interferes. From Cristianstad and Helsingborg connection is available as far as Frankfort-on-the-Main and Leipzig. The lines used for this traffic are equipped with special apparatus, making it possible to talk into the ordinary instruments installed in all offices here. The rates for three-minute conversations from Gothenburg are: To Hamburg, 67 cents; to Bremen or Berlin, 80 cents. The provision of these facilities for the ready transaction of business constitutes an added advantage for the German exporter doing business in Sweden.

Of Interest to the Trade

By A. L. Haase

Chase Autos in Telephone Work

It seems almost incredible in this age of modern improvement that there should be doubt in the minds of any of the superiority of the motor wagon over the horse-drawn vehicle.

There is no branch of delivery, carting or trucking in which a self propelled wagon has not all the advantages of the horse drawn wagon, and in addition is without many of the disadvantages of the latter.

Telephone line repair work, with its necessity for a truck that would go into practically all parts of the division with never a halt or protest against the poor roads which were bound to be run into, seemed to be one of the most open fields for the truck manufacture.

A. M. Chase, of the Chase Motor Truck Company, was one of the first to see this opportunity, and his well designed motor wagon for line repair work has proved so satisfactory that very few improvements have been made on the general design of the wagon since the construction of the first.

That the wagon has served its purpose is evinced by the interest that was aroused by the announcement that the Chase people were to put out such a wagon, and the instant favor that greeted its arrival on the market. That it has not deteriorated in value to the telephone companies is demonstrated by the repeat orders for Chase wagons that come into the Chase factory with almost startling regularity.

As shown by the accompanying illustrations the Chase is ideally constructed to do the work for which it is designed. Its construction is such that every inch of space is utilized. Attention is called to the ease with which ladders are carried and the cables fastened to the rear of the car.

The Postal Telegraph Company uses this style wagon with complete success in the mountainous regions of Pennsylvania, in addition to cars in other parts of the country where the thoroughfares are more traversed and the landscape level rather than hilly.

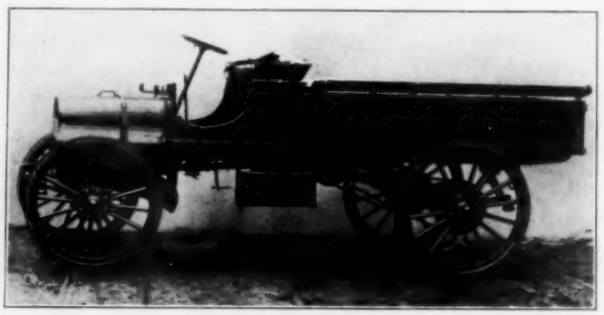
The Bell Telephone Company has placed orders

A Loaded Chase Truck.

for these in varying quantities seven times. That the entire fleet is running satisfactorily is one of the many proofs of the serviceability of the Chase wagon.

The Chase is not an assembled proposition in any sense of the word. The entire car is built in the Chase factory under the direct supervision of the designers of the first car and each car must undergo a rigorous test before it is consigned.

The quantity repeat orders spell the Chase success. The car is not guaranteed for any specific number of years, as the first Chase built over five years ago, is still in operation, as are all the cars turned out



A Chase Telephone Wagon.

in succeeding years, and consequently it is not known how long it will stand up.

Mr. Chase has given much time to proving that the motor wagon shows a saving over the horse-drawn vehicle. His figures accurately demonstrate that the motor wagon does the work of three horse drawn vehicles, and this at such a saving that in two years time the wagon has more than paid for itself.

The Men Behind Thompson-Levering Instruments

In the manufacture of electrical measuring and scientific instruments, business reputation carries great weight, and any new company is an unknown quantity until it has proven its ability to design and produce a high grade of apparatus. A little insight into the personnel of the Thompson-Levering Company will perhaps be appreciated here.

Mr. Levering, the technical engineer, has been in the electrical measuring instrument business from boyhood. The last 17 years were spent with one of the largest instrument houses in this country, where he had charge of all the high grade precision work over a wide range of instruments, such as standard resistance, standard condensers, testing sets, potentiometers, photo metric standards and other instruments requiring the highest precision. Mr. Levering has entire charge of the Thompson-Levering shop, and besides attending to the design of new apparatus, looks particularly after the resistance department and the standardization work, ably assisted by the best workmen that are to be procured, and by men who have had long experience in these lines.

Mr. Corcoran, the head of the galvanometer department, has also put in his entire business experience in the manufacture of high grade instruments, and for eight years prior to January 1, 1910, was with the same company as Mr. Levering, where he had charge of the galvanometer and meter department. He has had wide experience in the design and construction of galvanometers and meters of practically every manufacture in this coun-

try and abroad, making a specialty of this branch of the scientific instrument business.

Mr. Thompson, who looks after the executive and sale departments, is a graduate engineer, and formerly was manager of the electrical department of a large scientific and electrical instrument house for some years. His experience in this particular line dates back ten years.

These young men with their broad experience, coupled with the optimism of youth and the ability to do and dare, have surrounded themselves with a shop full of the highest grade of workmen—men who have learned their trade in the oldest instrument houses in this country and Europe, to whom nothing short of perfection is satisfactory, and all of this knowledge and experience is placed at the service of customers.

The United States Navy Department, after the most vigorous, painstaking tests and requirements, have purchased instruments of Thompson-Levering make, and to any one realizing the high standard our government requires of such testing instruments, this fact alone is a guarantee that perfection has been nearly approached by this company. Many of the largest telephone companies have certified to the worth of these instruments. The Western Union Telegraph is among the users also as well as the biggest independent telephone company in the United States. The advertisement of this company has been appearing in TELEPHONE ENGINEERING for some months.

A Telephone Protector for Outdoor Service

A type of open space cutout in extensive use throughout the country today on telephone lines, both in railroad and commercial service, is the so-called No. 86 type protector, manufactured by the Western Electric Company.

This protector is made in two forms—one with a tin cover and the other with a cast-iron cover, known, respectively, as the Nos. 86-A and 86-B. These covers are chained firmly to the framework of the protector

Fig. 1. No. 88A Protector, Covered.

mounting, so that they cannot be lost through carelessness of the lineman.

The protector itself is mounted on a porcelain base through the bottom of which the leading-in wires are brought in, and consists of heavy carbon blocks as shown in the illustration. The spacing between these blocks regulates the voltage at which the protector operates. Under normal conditions, this is adjusted to discharge at 1,000 volts.

The shape of the carbon blocks gives a variable gap between the ground block and the two blocks connected to the line wire. The protectors are arranged so that carbon dust carried across by the discharge will not clog the spark gap, but will automatically drop to the bottom of the protector.

The No. 86 type protector, as is noted, is designed for use both outside and indoors, and it is arranged so

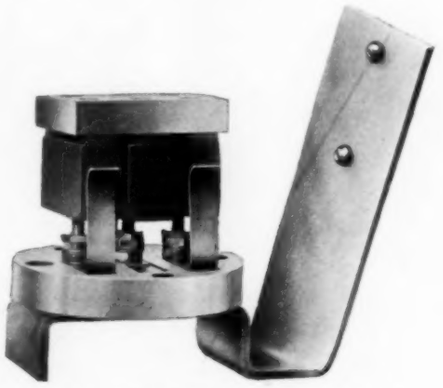


Fig. 2. Cover Removed, Showing Carbons.

that it can be mounted directly on the pole itself. In some cases, it is desirable to have a protector which can be located in this manner outdoors, although as a general proposition, such a practice is not to be recommended on account of the additional maintenance difficulty thereby involved.

On telephone train dispatching lines, the No. 86 type protector is being used to a considerable extent throughout the country today, and it is giving very good satisfaction.

Simple, Safe Preservative

The Bruno Grosche Company, 123 Jones lane, New York, has just sent out circular matter bearing testimonials and argument why S. P. F. Carbolineum should be the best for use by telephone companies.

The company claims that since creosoting makes the wood heavier the purchaser of creosoted products not only pays the pole or cross arm company for doing the work, but in most cases pays the freight on this additional weight.

S. P. F. Carbolineum is a non-inflammable oil which is shipped direct to the telephone company in cans.

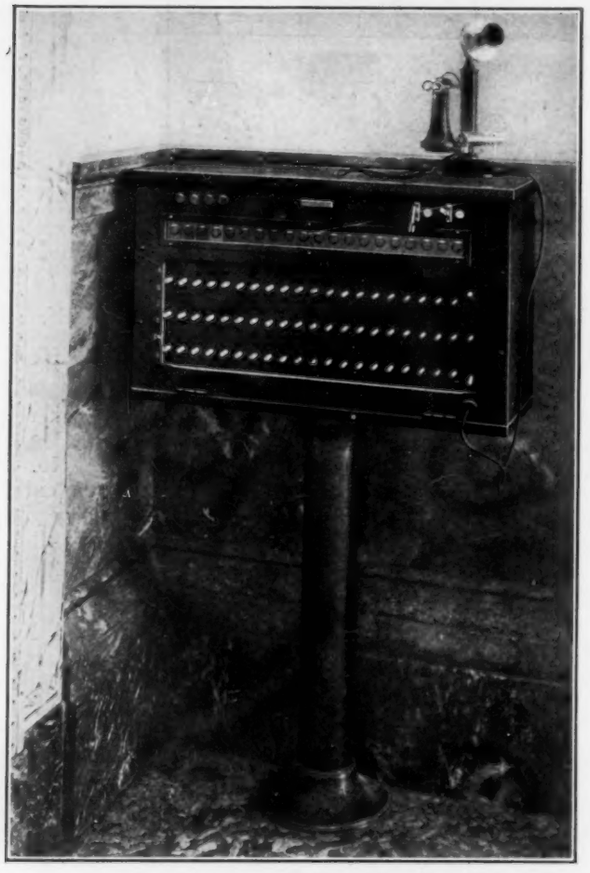
The preservative can be applied with an ordinary flat brush in the pole yard and especially after gaining or roofing a pole out on the job, affording an easy, economical method of preserving poles, cross arms, brackets and pins from wet weather, damp earth or boring insects, adding 100 per cent to the life of these articles.

It is stated that no pole treated at the shipper's yard can be filled with preservative to stop dry rot at the gain or on a new cut roof, and S. P. F. Carbolineum appears to be the ideal preservative for this reason.

The United States government and many prominent telephone companies are listed as users of this product for many years, and this in itself is a guarantee to the inquiring non-user. A postal to the company will bring facts and prices when mentioning TELEPHONE ENGINEER.

Cordless P. B. X. Facilitates Elevator Service

There are today in greater New York 14,262 private branch switchboards. These range in size from the small four-line board, with two trunks, to the large ten-position boards installed in some of the department stores and hotels. The new McAlpine hotel, which is now being erected in New York, will be equipped with 1,800 telephones and have 100 trunk lines. The Waldorf-Astoria's present capacity is 1,500 lines, 1,260 of which are now in use. One of the most interesting installations in the city, however, is a 20-line cordless board which has been installed in the Metropolitan building. This switchboard was designed by the Western Electric Company especially for use in connection with the elevator service.



Elevator Switchboard in the Metropolitan Building.

In a building of this character where there is express elevator service, one man must be responsible for each group of elevators. He must keep each car moving and be able to start or stop them at any floor. This switchboard enables him to do this, and, in addition, some of the lines are used in connection with the service department of the building and enable the superintendent, the electrician, the engineer, etc., to keep in touch with one another.

The switchboard shown in Fig. 1 is mounted on an iron pedestal, near one of the group of six elevators which run to the 44th story. It is equipped with four transfer circuits and twenty lines, each of the first six lines connected with a telephone in each of the six elevator cars, and the other lines being used for general purposes. By using the telephone in the car the elevator operator can keep in touch with the starter, who is located on the ground floor near the switchboard. If anything happens to the car, the elevator man can at once inform the starter, who in turn can notify the electrician and elevator department of the building. If a passenger wants to know on what floor a certain party is located, the elevator man can find out for him by calling up the starter and thus save the man a trip back downstairs.

When a safe is to be moved from one floor to another, it becomes necessary to make changes in the gear equipment of the elevator, and the telephone comes in very handy. The starter can, by means of the telephone located at the top of the elevator shaft, notify the engineer in charge of the elevators as to which elevator the safe is to be carried on, its weight, and how far it is to be raised, and the engineer, in turn, can then make the necessary changes in the gear. Without the telephone it would be necessary for the two men to get together, one at least leaving his post, and this would interfere with the regular workings of the elevators.

A Leeds and Northrup Fault Finder

As shown by the illustration, this fault finder is a compact little instrument measuring only 6½ by 8 by 10½ inches with a convenient carrying handle attached to one side.

It is a simple, reliable instrument which should form a part of every telephone company's equipment. It is used to locate crosses and grounds on telephone and telegraph lines and for the measurement of conductor or insulation resistance.

The L. & N. Company has shown so much forethought for the working lineman that it has eliminated the usual Algebraic signs and formula from this instrument, and anyone who can do simple addition and multiplication can get as perfect results with this instrument as can the trained technician.

The L. & N. Fault Finder.

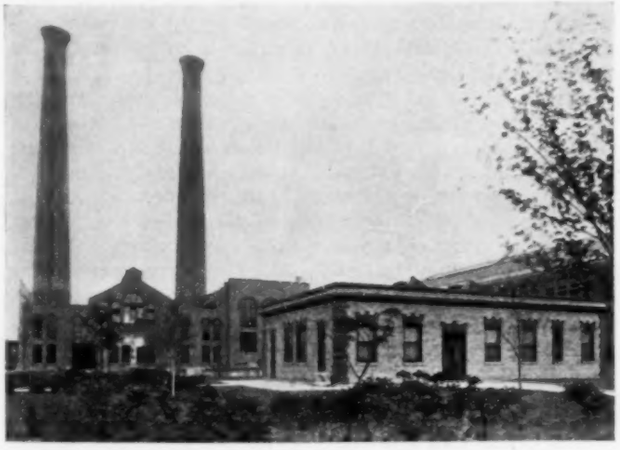
The 5400 dial decade portable testing set which this company sells is also one of the highest types of instrument made in this country from its description, and in its final design it combines the suggestions of the leading telephone and telegraph engineers with what was already a perfect theoretical masterpiece. The additions and suggestions obtained from practical everyday use by these

engineers has made this set a practical necessity to every telephone company.

The Leeds and Northrup Company, 4901 Stenton avenue, Philadelphia, will mail interesting literature to any one interested who mentions TELEPHONE ENGINEER.

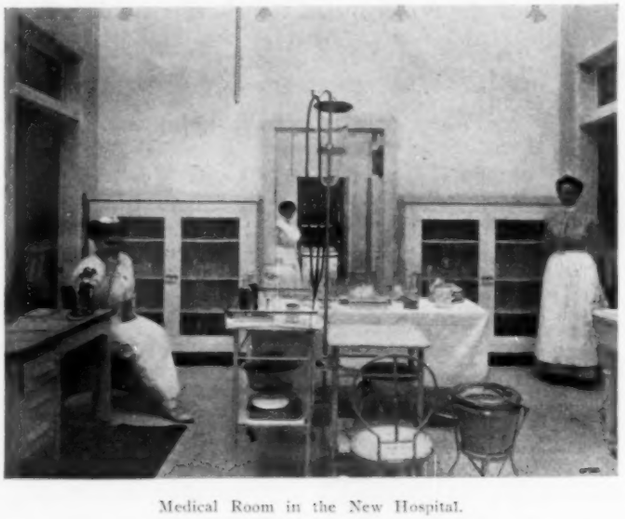
New Hospital at Hawthorne

Approximately 13,000 employees of the Western Electric Company are situated at Hawthorne, just outside of Chicago. The company's property at this point occupies more than 150 acres, and here are gradually being concentrated all of its manufacturing activities.



Western Electric Hospital at Hawthorne.

With the realization that it is necessary to look after the welfare of so many workers, the company has recently built and equipped an emergency hospital on the grounds. Its object is not only to relieve distress in time of accident, but also to give aid to any who are taken sick while on duty.



Medical Room in the New Hospital.

Every detail is complete to furnish surgical aid in cases requiring it, this aid ranging from the major surgical class to fine and delicate operations on the eyes. The hospital does not take care of chronic cases, but merely gives aid in acute cases.

This is not a general hospital, but has been organized for emergency work only. Its construction and the arrangement of its rooms have been to carry out the thought of emergency work and to care for accidents that arise. Its service is furnished free of expense to employees.

The hospital is equipped throughout with White Line surgical furniture of the latest type and pattern. All rooms wherein surgical work is performed are finished in white enamel, and the walls and woodwork are dust proof. To facilitate cleaning, all the woodwork has been made with round corners. The operating room has no outside openings. There is a double glass overhead skylight and sealed and filtered air is furnished to the room.

Corner of a Ward.

Reception rooms are separate for men and women, both opening into a central surgery, where all minor surgical work and redressing is performed. This dressing room contains an X-ray machine, eye magnet, vibrator and equipment for eye examinations. Two wards are provided for men and women, where every appliance is at hand to add to the comfort of the employees. There are also rooms for the use of the surgeon and the nurses.

The hospital staff is headed by a surgeon in chief and a supervising nurse. Service is continuous day and night.

Keystone Instrument Co. Has New Management

An important change in the management of the Keystone Electrical Instrument Company of Philadelphia has just taken place, Richard P. Brown becoming president of the company, and J. Franklin Stevens resigning. J. W. W. Cornman, the former secretary, will continue in this capacity and Mr. Stevens' advice and interest will still be with the company.

Richard P. Brown has for a number of years been president of the Brown Instrument Company of Philadelphia, established in 1860, the oldest concern in the United States manufacturing pyrometers, and this company has naturally had a wide experience in the design and manufacture of scientific instruments.

The voltmeters and ammeters manufactured by the Keystone Electrical Instrument Company have always been designed in a manner to meet particularly general industrial service, and under the suggestions of Mr.

Brown, slight changes in construction have been made, which will particularly recommend them to engineers who will recognize these improvements. The sales will also doubtless increase through the live organization of the Brown Instrument Company.

By this arrangement the Brown Instrument Company and the Keystone Electrical Instrument Company will manufacture pyrometers, thermometers, speed indicators, draft gauges, recording gauges, voltmeters and ammeters. In fact, the company is now in a position to manufacture or repair practically any type of instrument.

In addition to the works and office at Ninth street and Montgomery avenue, Philadelphia, an office will also be maintained for the present at 311 Walnut street and branch offices of the Brown Instrument Company at Pittsburgh and Chicago will now also handle Keystone instruments, and will, of course, be continued.

Western Electric to Establish House at Richmond

That the officials of the Western Electric Company are firm believers in the present prosperity and great future of the South is evinced by the fact that they will soon open a new house there. Arrangements have just been completed whereby the Western Electric Company will soon open a new house at Richmond, Va., where a complete stock of telephone apparatus and supplies, power apparatus and general electrical supplies will be carried. This will enable the Western Electric Company to give its customers in this territory the same prompt service which characterizes that given by the other twenty-four houses of the company's distributing organization.

H. W. Hall, formerly manager of the Denver house, will have charge of the Richmond organization, and with him will be associated specialists on the various lines handled.

For July the Western Electric Company's gross sales show a falling off of 3 per cent as compared with July, 1910, but the seven months of the current fiscal year which have elapsed are 4 per cent ahead of the corresponding period of last year. It now seems unlikely that the company will realize its earlier prospects of a $71,000,000 year, but the showing to date, which is at the rate of $66,000,000 for the year, is close behind the company's high record of $69,000,000 for 1906. The cable manufacturing department shows the chief decrease, the electric supplies branch shows a small gain and business in telephone apparatus is good.

It is of interest that with an increase in its number of customers, the average size of each order decreases. Last year the average of sales was $72, which was considerable decrease over a period of years, and this year the unit of sales is in the neighborhood of $70. The Western Electric is employing 26,000 persons as compared with 29,000 in 1906, which was the largest number ever on the company's books at any one time. On January 1, 1909, there were less than 18,000 persons employed, which number has been increased to 23,500 approximately, at the beginning of the current year.

Creditors of the American Electric Fuse Co., which was involved in the financial operations of its president, Frank G. Jones, have decided that the business is not profitable and have made arrangements for closing the plant at Muskegon, Mich. About 600 men will be thrown out of employment.

New Interphone Bulletin

"The Selection, Installation and Wiring of Interphone Systems" is the title of bulletin No. 1105, a new thirty-six-page publication which the Western Electric Company has just issued. It is a most complete and comprehensive bulletin on the subject of interior telephone systems and is illustrated with sixty-six cuts and diagrams. Twelve different systems are described in this bulletin, and in it are also shown sets ranging from the No. 1327 type, a set used for two to six-party, common ringing and common talking service, to the No. 1335 type, a set used for twenty-four station installations where selective ringing and selective talking are desired. This bulletin tells how to choose the best system for every conceivable service, and gives valuable information on the installation of the sets.

The section of the bulletin describing the various methods of running and connecting cable, the method of installing the sets and forming the cable at the cable terminals, is especially valuable, as it is profusely illustrated and shows just how the work is to be done.

Two new systems are shown, one a selective ringing, common talking set, made in both four and eight button types to accommodate five and nine party service, the other a selective ringing, common talking set for limited service. This limited service is one where, from a master station a call may be made to any outlying station, and the master station may in turn be called from any outlying station.

The No. 1335 type set, a metal wall set in capacities for 16, 20 and 24 line stations, is also described, as well as the No. 19 cable terminal. In addition to these new sets, all the standard sets manufactured by the company, together with accessories and supplies necessary for the complete installation of inter-phone systems, are shown.

The Butler Electric Company, David City, Neb., has issued an attractive little booklet about "The Machine that Solves the Ringing Problem." The Butler ringing machine and the Butler special transformer are described and illustrated. The company is having great success with its devices, and already has supplied a large number of large and small operating companies with ringing equipment.

W. N. Matthews & Brother, St. Louis, have issued No. 2 of the folder entitled "Anchoring Under Difficulties," showing a series of photographs of peculiar and difficult anchor locations, problems whose successful solution meant much to the operating companies which met them. Those who have similar difficulties should lose no time in getting in touch with the Matthews people.

The C. A. Wood Preserver Company, St. Louis, Mo., has issued an interesting booklet on "Wood Preservation for Electric Railways." While the subject matter has mostly to do with railroad ties, the principles of wood preservation are explained in an interesting manner.

The Duplex Metals Company has issued a circular of ground rods, carrying a pictorial comparison of copper, iron, and copper clad rods. "Did you know we made them?" the company asks. Users who did not know will profit by getting better acquainted with the fact.

Chinese Telephone and Telegraph Systems

Consul General Amos P. Wilder, Shanghai, says that improvements in the telephone and telegraph systems of the Chinese Empire are being made in accordance with a program adopted by the Board of Posts and Communications. This program was arranged to cover nine years, beginning with 1908 and ending with 1916. An abstract of the program, showing the improvements yet to be made, follows:

During the present year depots will be established for experiment purposes and also for the manufacture of telegraph and telephone instruments and materials. The following additions will be made to already existing telegraph lines: In Hunan, Hunkiang and Yungchow lines; in Honan, the Chow-chia-kou and the Hoachow lines in Amuri; in Manchuria, the Anhui Province lines; in Kwangtung, the Kaochow-Pi-ching lines. Plans will be made for the erection of wireless-telegraph stations along the seacoast. Experiments will be made with automatic telephones in the city of Peking. The telephone systems at Tientsin and the Provinces of Kiangsu and Chekiang will be extended and enlarged.

In 1912 the northern and southern telegraph circuits of Shensi and Shansi Provinces will be extended, as well as certain lines in Kwangtung Province from Foshan to Hsun-teh-hsiang-shan. Officers will be sent abroad to investigate foreign-made electrical materials and compare them with materials manufactured in China. Telephone and electric-lighting systems in Hupeh Province will be extended, and telephone installations in Hunan and Shantung Provinces will be experimented with.

In 1913 China will participate in the international electrical conference. Telegraph lines will be constructed from Fuchow in Kiangsi Province to Ying-chih in Fukien Province, and from Chi-an in Kiangsi to Ti-ling in Hunan. Experiments are to be made with automatic telephones at Canton, Tientsin, and Shanghai; and with telephones in Shensi and Honan Provinces.

In 1914 telegraph lines will be extended from Hsing-i in Kwei-chow to Kwang-nan in Yunnan and from Chengtu to the capital of Szechwan Province and to points in Kansu Province. Further depots for the experimental manufacture of electric lighting, submarine cables, and all kinds of materials for electrical appliances will be established. Telephone systems will be tried in the Provinces of Kweichow, Yunnan, Szechwan, Kwangsi, and the systems already in operation in Shansi Province will be extended.

In 1915 extensions will be made to the lines between Pu-erh and Hsunning in Yunnan; and to the lines between Ching-yuan in Kwangsi and Kuei-yang in Kweichow. A survey will be made for a line between Urga and Kobdo, Mongolia. A depot for the manufacture of all materials used in wireless telegraphy will be enlarged. Experiments will be made with telephone systems in Kansu and the New Dominion (Hsin Chiang). Telegraph lines in both inner and outer Tibet will be extended.

In 1916 telegraph lines in inner and outer Mongolia will be extended. Plans will be made for the construction of telegraph lines from Pao-t'eu-Chen to Ning-hsia, from Kansu to Ching-hai and inner Tibet, and from Ili to Kuche. The telegraph lines in the northwest provinces will be reconstructed and the general improvement of all the electric-lighting plants and telephone systems in the empire will be undertaken.

It is impossible to say how much of this program will actually be put into operation, much depending upon the funds at the disposal of the Board of Communications. Only by stationing a representative at Peking who will have access to the officials of the board will it be possible effectively to keep in touch with the actual operations in the way of the construction and extension of telephone and telegraph lines in this empire.

Southwestern Company Studying Development

The Southwestern Telephone Company, warned by the remarkable growth Fort Worth, Texas, has made in the last census decade, is making an attempt to provide for the future growth of the city in the next fifteen years. A corps of expert telephone engineers is making a careful survey of the city, and an estimate of its probable growth that they make will set the plans for the telephone service and its increases as far ahead as 1926. When the engineers' plans are made they will guide all construction of the comapny until the period is ended or modification is required by abnormal growth or stagnation.

General Commercial Superintendent P. K. Baker says:

"Our plans are to arrive at some reliable estimate of the demands that will be made upon us in the years to come, and prepare to meet them so that when the time comes we will not have to face new problems or find ourselves with inadequate facilities in the way of construction to give the service that a remarkable growth compels us to give. This is a lesson we learned in the growth of Fort Worth in the past ten years. We are following the same policy in Houston and expect to in Dallas. We propose to figure to the closest possible margin the number of houses and the population Fort Worth will have in the next fifteen years, and from those figures arrive at the probable number of telephones we will require to have in use.

"The corps of engineers will also select sites and report on the number of exchanges necessary. The survey will extend to the business lots with an estimate of the size and character of the business houses that will be probably located on them at that time. All of this data is necessary to determine the number of telephones that will be used then."

Telephones for New York Harbor Police

New York Police Commissioner Cropsey has issued orders to take effect April 1, which will revolutionize the Harbor Police Squad. Signal stations will be established and telephones placed at convenient points along the water front, so that reports may be received at headquarters from the police launches.

At present there are fourteen launches in the harbor squad, each of which is manned by a sergeant and three policemen, one of the policemen being an engineer. By the new orders several stations will be established, with a policeman in charge at all hours, to receive reports from the harbor police and transmit them by telephone to headquarters, as well as to receive applications for assistance from private sources. At One Hundred and Thirty-first street and the North river and at Clason Point signal stations will be established so that police launches may be called to any place.

All told, there will be seventy-four places where telephone communication can be effected with headquarters, and after April 1 it will be the duty of every launch commander to report on post and to make frequent reports of his whereabouts.

Brevities of the Business

PERSONAL NOTES.

John C. Jennings, residence 6449 Yale avenue, Chicago, Ill., died at six o'clock Saturday evening, August 19, at the Englewood hospital. His death was due to carbuncle and diabetes. Mr. Jennings was born at Bellaire, Ohio, June 4, 1862, at which point he received a high school education. He was employed by the Pennsylvania Lines west of Pittsburgh from 1878 to 1904, and held successive positions with that railroad as follows: At Bellaire, Ohio, from 1878 to 1881, one year as messenger, two years as yard clerk; Wellsville, Ohio, 1881 to to 1898, one year as copying operator and sixteen years as train dispatcher; Cincinnati, Ohio, 1898 to 1901, as chief dispatcher, and in the same capacity at Fort Wayne, Ind., from 1901 to 1904. In July, 1904, he was offered the position of superintendent of telegraph by the Rock Island Lines, which position he accepted and held until the time of his death. He had been at the hospital two weeks, but death came suddenly at the end. He is survived by his wife, daughter, Mary, and son, Joseph. Mr. Jennings, in all of the successive positions held by him, has shown marked ability in his line, and has obtained results; this being especially true with respect to the position which he held at his death. His untimely death comes as a shock to his many railroad and other friends, both in Chicago and throughout the country.

William Dunlap Sargent, of Brooklyn, N. Y., died August 10, at Somerset, Pa., his country home. Mr. Sargent was one of the most widely and popularly known men in the telephone field. He was born in Ligonier, Westmoreland county, Pa., in 1845. He was educated in the public schools at Harrisburg, Pa., and became a telegraph operator for the Pennsylvania Railroad. In the civil war he served in the United States Military Telegraph Corps at General Burnside's Cincinnati headquarters, and afterwards became manager of the Western Union office there. He was in charge of the telegraph service at the Centennial Exposition in Philadelphia and was present when Prof. Alexander Graham Bell first exhibited his telephone there. Mr. Sargent then entered the telephone business with Thomas E. Cornish of the Bell Telephone Company, of Philadelphia, as general superintendent and general manager. Later he went to Brooklyn and became vice-president and general manager of the New York & New Jersey Telephone Company, and while there was chosen to take charge of its exhibit at the Paris Exhibition in 1889. In 1885 he developed, in connection with John A. Barrett, the dry core paper cable in a continuous lead covering, the cable which is now in standard use in the telephone business. He was active in the long-distance work of early days, and is recognized as one of the first and ablest of the pioneers in the telephone field. Mr. Sargent was a director of the National City Bank of Brooklyn and of the Brooklyn Public Library. He was a member of the American Institute of Electrical Engineers, the Brooklyn Institute, the Pennsylvania Society, the new England Society and the Long Island Historical Society.

W. K. McQuown, superintendent of the Atchison (Kan.) Telephone Company, has resigned to take a position as superintendent of plant with the Home Telephone Company, Joplin, Mo. This change really means a promotion for Mr. McQuown, as both companies are included in the "Gary System" of telephone companies. Mr. McQuown came to Atchison two years ago, and has many friends there. He will have entire supervision of operation, maintenance, and construction on those exchanges, and the connecting toll lines in Joplin.

Pona E. Focht of Chicago has been appointed superintendent of the automatic telephone exchange in Newark, O., and is now in charge of the work. The appointment was made by Manager Charles Hollander. Mr. Focht assisted in installing the new automatic plant and so proficient and thorough was his work that Manager Hollander entered into negotiations with him to take charge of the superintendency of the plant.

C. P. Lindsley, president of the Lindsley Brothers Company, manufacturers of western cedar poles and cross-arms, Spokane, Washington, is making an extended inspection trip to the company's pole yards which are located in northern Idaho, northeastern Washington and British Columbia. The British Columbia headquarters are at Nakusp on Arrow Lake.

Frank B. Cook, of telephone protector fame, and Mrs. Cook are spending the summer months traveling in Europe.

J. W. Edwards and J. C. Kelsey, of the Kellogg Switchboard and Supply Company, have returned from a fortnight's sojourn at West Baden, Ind. Mr. Kelsey has quite recovered from the fatigue incident to the experience.

The many friends of R. A. Peet, formerly Chicago sales manager for Hazard Wire Company, and later in charge of special sales for this same firm at New York City, will be interested to learn that "Bob" has left the Hazard Company for the educational field and will teach special subjects at Blackhall, Conn.

L. L. Hill of the Page & Hill Co., large shippers of telephone poles, called at the office of Telephone Engineer last week. Mr. Hill stated that business was getting better and shipments for fall construction were being made from the Minneapolis stock in a satisfactory manner. This company recently installed a complete tank system for applying preservative to poles.

Under the new organization known as the Central Group of Bell Telephone Companies, the following changes take place in the personnel: B. E. Sunny, president of the Central Group of companies, was formerly president of the Chicago Telephone Company. Alonzo Burt, vice president and treasurer, was formerly president of the Wisconsin Telephone Company. B. W. Trafford, vice president, was formerly vice president and general manager of the Michigan State Telephone Company. Charles E. Mosley, secretary of all the companies except the Michigan State, was formerly secretary and treasurer of the Chicago Telephone Company. L. G. Richardson, general counsel, was formerly president of the Central Union Telephone Company. H. F. Hill, general manager, was formerly vice president and general manager of the Central Union Telephone Company. B. S. Garvey, general auditor, was formerly auditor of the Chicago Telephone Company. W. J. Boyd, assistant secretary and assistant treasurer, formerly held the same position with the Chicago Telephone Company. C. L. McNaughton, assistant treasurer was formerly assistant treasurer of the Central Union Telephone Company. J. L. Proctor, assistant treasurer, was formerly supervisor of printing for the Wisconsin Telephone Company. H. O. Seymour, general agent for public relations, was formerly general manager of the Wisconsin Telephone Company. A von Schlegell, general commercial superintendent of all except the Chicago Company, was formerly general contract agent of the Michigan State Telephone Company. L. N. Whitney, agent for connecting companies, was formerly general superintendent of the Central Union Company for Indiana. H. W. Paddock, tax attorney, was formerly tax attorney for the Central Union Telephone Company. S. J. Larned, general traffic superintendent, was formerly general superintendent of the Chicago Telephone Company. E. A. Reed, general plant superintendent, was formerly general superintendent of the Central Union Telephone Company for Ohio. J. G. Wray, chief engineer, was frrmerly engineer of the Chicago Telephone Company. John Uprichard, auditor of disbursements, was formerly auditor of the Central Union Telephone Company. H. J. Booth, auditor of receipts, was formerly auditor of the Michigan State Telephone Company. J. J. Kelley, chief traveling auditor, was formerly chief clerk of the auditing department of the Chicago Telephone Company. A. B. Crunden, general bookkeeper, was formerly general bookkeeper of the auditing department of the Chicago Telephone Company.

W. M. Brown of Colorado City, Colo., has been appointed local manager for the Pacific Telephone and Telegraph Company at Escondido, Cal., to succeed S. L. Thomason, who resigned to take a position with the company at San Diego.

C. T. McDaniel, formerly district manager for the Ozark Bell Telephone Company, with headquarters at Springfield, Mo.,

has been appointed assistant to the general commercial superintendent of the Missouri and Kansas Telephone Company with headquarters in Kansas City.

M. H. Clapp has been appointed superintendent of the telephone and telegraph service of the Northern Pacific railway to succeed O. C. Greene, resigned.

Charles E. Hall has been appointed general commercial superintendent of the Bell Telephone Company for Iowa and Nebraska, with headquarters at Omaha. Mr. Hall has been acting as assistant superintendent with headquarters at Des Moines.

O. A. Hopkinson has been appointed plant chief of the Bell Telephone Company at St. Anthony, Idaho. He will be succeeded as manager of the company's exchange at Pocatello by H. Graham.

Thomas Sanders, one of the organizers and first directors of the original Bell Telephone Company, recently died at Haverhill, Mass.

J. C. Clemens has been appointed manager of the Arizona Telephone and Telegraph Company, formerly the Consolidated Telephone, Telegraph and Electric Company, at Tucson, Arizona.

W. K. McQuown, superintendent of the Atchison Telephone Company, Atchison, Kans., has been appointed superintendent of the Home Telephone Company, Joplin, Mo. He will be succeeded by C. H. Pelty.

Marion Wilson, South Whitley, Ind., has invented a small metal appliance which when attached to the transmitter of a telephone greatly magnifies the voice of the speaker. Application has been made for a patent.

James Applegate has been appointed manager of the Eureka Telephone Company, Corydon, Ind.

P. N. Pattison, formerly manager of the Montrose district of the Colorado Telephone Company, with headquarters at Montrose, Colo., has been appointed manager of the Trinidad district with headquarters at Trinidad. He will be succeeded by B. W. Emmerson.

Keith N. Taylor, commercial manager for the Southwestern Telephone Company at Lockhart, Texas, has been promoted to a position in the district manager's office at Austin.

D. W. Gibbs has been appointed manager of the Mountain States Telephone and Telegraph Company at Salt Lake City, Utah. Mr. Gibbs has been identified with the local company for four and a half years and in that time has steadily advanced from one position to another.

L. M. Lax, for the past eight years wire chief of the Bell Telephone Company at Edwardsville, Ill., has been promoted to the position of plant chief and will have charge of the exchanges at Edwardsville, Highland and Collinsville. Mr. Lax will be succeeded at Edwardsville by C. E. Herrin of Alton.

P. H. Coolidge, assistant general manager of the Pacific Telephone and Telegraph Company at San Francisco, has been transferred to the position of general commercial superintendent and George B. Bush, formerly general commercial superintendent, has been transferred to that of assistant general manager.

R. F. Morris, formerly general manager of the Tri-State Telephone and Telegraph Company, with headquarters at El Paso, will be division general manager for the northern division of the Mountain States Telephone and Telegraph Company, recently formed to take over the above company and the Rocky Mountain Bell Telephone Company.

Samuel Jones, manager of the Independent Telephone Company at Provo, Utah, has been appointed manager of the Nephi district of the Mountain States Telephone Company, with headquarters at Nephi.

W. N. Davidson was recently appointed manager of the Gage County Telephone Company, Blue-Springs, Nebr.

E. R. Westcott has been appointed superintendent and wire chief for the Mutual Telephone Company, Summerfield, Kans.

M. C. Marsh, local manager of the East Tennessee Telephone Company's exchange at Jefferson City, Tenn., has been promoted to the management of the Johnson City exchange of the company.

A. R. Skinner, of the traffic department of the American Telephone and Telegraph Company, New York, has been appointed supervisor of traffic of the fourth division of the company at Chicago.

Upon his departure for Cleveland, Ohio, where he goes as traffic superintendent of the Bell Telephone Company, N. Anderson, formerly of the traffic department of the Chicago Telephone Company, Chicago, was tendered a banquet by the department.

Ralph Wainwright Pope, who for more than twenty-six years has served as secretary of the American Institute of Electrical Engineers, recently resigned his position. As a mark of gratitude for his long and distinguished service, and also that the Institute may still have the benefit of his long experience in its affairs, the directors appointed Mr. Pope honorary secretary. President Jackson appointed the following committee to co-operate with the president-elect in canvassing for candidates to fill the position of secretary: Gano Dunn, chairman; H. W. Buck and W. S. Rugg.

The following persons were recently elected associate members of the American Institute of Electrical Engineers: Clarence Earl Fleager, division plant engineer, Pacific Telephone and Telegraph Company, San Francisco, Cal.; Walter Clarkson Freeman, salesman, Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y.; Robert Ripley Gleason, assistant traffic chief, American Telephone and Telegraph Company, Chicago, Ill.; George Polk Player, telephone engineer, Corporation Commission of Oklahoma, Oklahoma City, Okla.; Edward Pomeroy Staats, engineering assistant, New York Telephone Company, New York, N. Y.; Claudius Fletcher Stewart, installer, Automatic Electric Company, Chicago, Ill.; Charles Alexander Turner, electrical engineer, Pacific Telephone and Telegraph Company, San Francisco, Cal.

CONVENTIONS.

The annual convention of the North Dakota Independent Telephone Association will be held at Bismarck September 27 and 28 instead of August 15 and 16, as previously announced. L. C. Lane, Kensal, N. D., is secretary.

NEW TELEPHONE COMPANIES.

LINDEN, ALA.—Articles of incorporation have been filed for the Linden and Nanafalia Telephone Company, with a capital stock of $2,000. The officers of the company are: President, A. L. Hasty; vice-president, W. C. Dozier; secretary, B. F. Gilder; treasurer, W. E. Rhodes. It is the purpose of the company to install and maintain a telephone system in the towns of Linden and Nanafalia.

TUCSON, ARIZ.—Amended articles of incorporation have been filed changing the name of the Consolidated Telephone and Telegraph Company to the Arizona Telephone and Telegraph Company.

CENTRALIA, ILL.—The Hanford, Shookum Telephone Company has been incorporated by A. Bannso and W. Eshem, with a capital stock of $1,500.

BAKERSFIELD, CAL.—The Delano-Linn's Valley Telephone Company has been incorporated with a capital stock of $10,000. The directors of the company are as follows: Ben Thomas, J. C. Rutledge, Ambrose Villard, Philip Girard and R. W. Lockridge.

COLUSA, CAL.—With the Colusa County Telephone Company as the leader, a number of telephone companies have been developed on the west side of the Sacramento Valley. The Tehama County Telephone Company is the latest to be organized which will install an all-cable system in Red Bluff. Butte and Shasta counties will be the next seat of operations.

ROCKLAND, COLO.—The Rockland Telephone Company has been incorporated with a capital stock of $10,000 by G. W. Morse, R. V. Lloyd and Fred T. Schulz.

DENVER, COLO.—The Mountain States Telephone and Telegraph Company, capitalized at $50,000,000, is the name of the organization formed to take over the Tri-State Telephone and Telegraph Company and the Colorado Telephone Company which have been consolidated. The new company has purchased the properties and franchise of the Rocky Mountain Bell Telephone Company and as successor to the Colorado Telephone Company now owns and controls the telephone business and properties of six states and crosses the borders of two others. The officers of the company are: President, E. B. Field; vice-president and treasurer, E. B. Field, Jr.; secretary, J. E. McDonald; general manager, E. M. Burges.

SWAN, GA.—The Swan Telephone Company has been incorporated by W. M. Allen, E. W. Butt, T. A. Brown, W. A. Bailey and others, with a capital stock of $5,000.

HOMELAND, GA.—The Homeland Telephone Company has been incorporated for the purpose of installing a local telephone system.

LEWISTON, IDAHO.—Articles of incorporation of the Pacific Telephone and Telegraph Company, a California company, capitalized at $50,000,000, have been filed for record with the county auditor.

NEW LEBANON, IND.—Articles of incorporation have been filed for the New Lebanon Mutual Telephone Company of Sullivan County, with a capital stock of $35,000. The incorporators are J. K. Coulson, Arthur Brown, G. D. Shafer, W. R. Willis and L. C. Baughman. It is the purpose of the company to install and

operate a telephone system in New Lebanon and throughout Sullivan County.

La Harpe, Ill.—The La Harpe Telephone, Ice and Power Company has been incorporated with a capital stock of $10,000 by Charles K. Todd, John H. Hungate and Abram G. Cox.

Rock Island, Ill.—The Tri-City Automatic Home Telephone Company has been incorporated with a capital stock of $1,000. The incorporators are J. A. Smith, B. Barth and M. Roelens.

Marshalltown, Ia.—Articles of incorporation for the Merchants', Mechanics' and Farmers' Telephone Company have been filed with the county recorder, with a capital stock of $100,000. The company was organized several months ago for the purpose of installing a telephone system throughout the county. The officers are as follows: President, F. M. Webster; vice-president, Robert Harper; secretary, F. E. Peek; treasurer, J. P. Cooper; directors, the above officers and M. E. Melvin, F. E. Dewitt, N. A. Evans, E. L. Williams, C. R. Lynch, Carver Ferguson, Henry Goecke, Jr., S. T. Kqeper, F. C. Davis, G. C. Ogler and Joe Haynes.

Paola, Kans.—The Miami County Telephone Company has been organized with a capital stock of $20,000. The officers are: President, J. M. Mannen; vice-president, C. M. McKoon; secretary, C. N. Emery.

Paducah, Ky.—Articles of incorporation have been filed by the West Kentucky Long-Distance Telephone Company, the capital stock being $600. L. G. Griffiths, Louisville, is one of the incorporators.

Lackey, Ky.—The Beaver Valley Telephone Company has been incorporated with a capital stock of $6,000 by John Camel, T. J. Craft, Lark Slone and M. M. Pratt.

Hellier, Ky.—The Citizens' Telephone Company has been organized with a capital stock of $5,000 by Fred H. Ratcliffe, W. E. Johnson, John H. Coleman and others.

Lone Oak, Ky.—The Lone Oak Telephone Company has been incorporated with a capital stock of $1,000. The officers are as follows: President, G. W. Potts; vice-president, J. J. Sanderson; secretary-treasurer, J. J. Breckenridge.

Lake Charles, La.—The Elton Telephone Company, Ltd., has been incorporated with a capital stock of $5,000.

Dexter, Me.—The Union Telephone and Telegraph Company has been organized and the officers are as follows: President, George S. Libby; treasurer, Edgar E. Ham; directors, H. T. Kittridge, M. E. Sevey, W. H. Hurd, Jeptha Bane, George S. Libby and Walter B. Gould. It is the purpose of the company to install a telephone system in Dexter and surrounding country.

Frederick, Md.—A farmers' independent telephone company has been organized in this vicinity and the officers are as follows: President, George L. Kauffman; secretary, Harry B. Witter; treasurer, J. Travers Thomas.

Coloma, Mich.—Articles of incorporation have been filed with the county clerk. The capital stock is $5,000 and the directors are George W. Grant, Stanley Guy, Abram Bachman, Jacob Fritz, Arvine S. Miller, Elsworth Chorpening and Sylvester M. Keigley.

Climax, Mich.—The Climax Citizens' Telephone Company has been incorporated with a capital stock of $6,000.

Chelsea, Mich.—On account of a raise in telephone rates the Mutual Telephone Company has been organized in this place. F. H. Belser, president of the Business Men's Association, has secured a franchise from the city for the new company.

Lanesboro, Minn.—The Farmers' and Merchants' Telephone Company has been organized with a capital stock of $10,000. The incorporators are M. W. Williams, president; T. T. Johnson, vice-president; A. M. Hanson, secretary; O. M. Habberstad, treasurer.

Swanville, R. F. D. 2, Minn.—The Morrison and Todd County Farmers' Telephone Company has been incorporated with a capital stock of $5,000 by L. J. Johnson, J. W. Strom, James Edwards, Lewis Olson and Leroy Chase.

Ellisville, Miss.—The Jones County Rural Telephone Company has been incorporated by W. N. Montgomery, J. O. Freeman and others with a capital stock of $10,000.

Chester, Mont.—The Sweet Grass Hills Telephone Company has been incorporated with a capital stock of $10,000, by John Laird, Frank Laird, of Laird; H. F. Smith, Hill; H. D. Price, and T. B. Strode, Whitlash.

Hardin, Mont.—Articles of incorporation of the Big Horn Telephone Company have been filed in the office of the county clerk. The company is capitalized for $20,000 and the principal place of business is Hardin. The officers are: President, D. A. Kemp; vice-president, G. F. Corwin; directors, U. S. Miller, Thomas W. Young and H. H. Cone.

Broadview, Mont.—The Treasure State Telephone Company has been incorporated by H. W. Bangert, Alfred Bonchard and E. B. Broadman of this place. The capital stock is $25,000.

Miner, Mont.—The Miner Rural Telephone Company has been incorporated by Hugo B. Hoppe, Millard T. Norman, and John Smith, Jr., with a capital stock of $2,000.

Helena, Mont.—The Montana Telephone Exchange Company has been incorporated by H. R. Collins, Carl Hill and C. R. Siegel, with a capital stock of $50,000.

Louisville, Nebr.—The Cass County Farmers' Mutual Telephone Company has been incorporated with a capital stock of $20,000.

Albany, N. Y.—Articles of incorporation have been filed with the secretary of state for the Deleware and Beaverkill Telephone Company to operate in Delaware, Sullivan and Ulster counties; capital stock, $5,000. The directors are Emmett J. Shaver, Mountain Lake; James D. Murdock, Arena; Emery Jenkins, Frank Vausse, William Reed, L. Roy Jenkins and John W. Keater of Union Grove.

Boonville, N. Y.— The People's Mutual Telephone Company has been incorporated with a capital stock of $5,000 and the directors are Eugene H. Hayes, Frank A. Barret, Andrew Harlout, all of Boonville.

Young Hickory, N. Y.—The Troupsburg and Young Hickory Telephone Company has been incorporated by Lewis Grenolds, R. M. Bliss, William Colegrove, Elry D. Potter, Albert Potter, Clarence Bates and Michael Keegan, of Troupsburg; capital stock, $1,000.

Garner, N. C.—The Garner Telephone and Telegraph Company has been incorporated by John T. Wrenn, McCullers; Henry Bryan, Garner, and Charles U. Harris of Raleigh; capital stock, $10,000.

Trenton, N. C.—The Jones Telephone Company has been incorporated by F. Brock, H. G. Monk and others, with a capital stock of $25,000.

Linwood, N. C., R. F. D. No. 2.—Articles of incorporation have been filed for the Fairmont-Silvey Telephone Company with a capital stock of $20,000.

Rollo, N. D.—The Rollo Rural Telephone Company has been incorporated with a capital stock of $10,000, by A. O. Graham, Arthur Dixon and Robert Fraser, all of Rollo.

Tahlequah, Okla.—The Telequah-Peggs Telephone Company has been incorporated by W. D. Harrison, H. P. Fisher, Jones Still and others, with a capital stock of $3,000.

Hollis, Okla.—The Hollis Telephone Company was recently incorporated with a capital stock of $20,000.

Konawa, Okla.—Articles of incorporation have been filed for the Orner Telephone Company. The directors are John T. Robnett, William I. Walker and Horne McFarland.

Muncy, Pa.—Samuel Rogers, H. C. Heilman, T. B. Eaker and Frank M. Opp have incorporated the West Branch Bell Telephone Company with a capital stock of $50,000.

Enon Valley, Pa.—Articles of incorporation have been filed for the Enon Valley Telephone Company by John H. Russell. The capital stock is $30,000.

Breezewood, Pa.—The McConnellsburg and Breezewood Telephone Company has been incorporated by Amos Hixon, Crystal Springs; John N. Hixon, Akersville; J. F. Poe, Breezewood; G. A. Harris, McConnellsburg and J. M. McKibbons, Buck Valley; capital stock $15,000.

Irwin, Pa.—The Farmers' Interurban Telephone Company has been incorporated with a capital stock of $5,000 by J. S. Rumbaugh, Amos Buzzard, G. E. Rumbaugh, J. M. Allshouse, E. G. Whitehead and W. H. Serough, Irwin, R. F. D.

Bedminister, Pa.—The Bedminister Telephone Company has been incorporated by Wm. S. Nichols, Lewis Keller, Joseph T. Diehl, John W. Nickel and Joseph Raum; capital stock, $5,000.

Glencoe, Pa.—Articles of incorporation have been filed for the Northampton Telephone Company with a capital stock of $5,000. The incorporators are L. D. Leydig, president; J. H. Miller, vice-president; G. H. Ellman, treasurer; S. W. Poorbaugh and W. S. Dahe.

Yukon, Pa.—The Yukon Waltz Telephone Company has been incorporated by F. C. Baughman, C. F. Hunker, H. B. Emerson and D. H. Keller, with a capital stock of $5,000.

Simpsonville, S. C.—The Home Telephone Company has been incorporated by W. D. Fowler, F. D. Hunter and S. L. Richardson, with a capital stock of $2,000.

Edgemont, S. D.—The Edgemont Telephone Company has been incorporated by A. J. Calgan, president and W. F. Wyatt, secretary; capital stock, $10,000.

Barling, Tex.—The Citizens' Telephone Company has been incorporated with a capital stock of $10,000. Andy Gehebe is manager.

BOERNE, TEX.—The Kendall County Telephone Company has been incorporated by John F. Nooe, Charles Reinhard and Adolph Wendler, with a capital stock of $10,000.

TYLER, TEX.—The Talbert Telephone Company has been incorporated by J. A. Talbert, J. G. Smith and M. Starnes; capital stock, $25,000.

CEDARHOME, WASH.—The Cedarhome Telephone Company has been incorporated with a capital stock of $10,000, by Peter Hanson and N. Neilson.

KENOVA, W. VA.—The Docks Creek Telephone Company has been incorporated by Lewis Rakes, John Skean, L. B. Chadwick and Fran Mitchell; capital stock, $1,000.

DUNLOW, W. VA.—The Wayne Dunlow Telephone Company has been incorporated with a capital stock of $5,000. The incorporators are T. J. Preston, of Quaker; W. E. Hardwick of Genoa; D. E. Hardwick, Wayne.

COWEN, W. VA.—The Cowen Telephone Company has been incorporated by J. J. Hartley, J. C. Kessler, B. F. Miller, A. G. Johnson, and D. C. Hoover, of Cowen.

MT. STORM, W. VA.—The Allegheny Mutual Telephone Company has been incorporated by J. H. Shaeffer, Mt. Storm; R. F. Secrist, Scherr; J. L. Aronhalt, Gormania; capital stock, $4,000.

MARSHFIELD, WIS.—The Marshfield Telephone Company has been incorporated with a capital stock of $50,000 by J. C. Marsh, H. E. Hoerl, Addie Williams, Amy E. Marsh and Martha Nelson.

MARINETTE, WIS.—The Harmony Telephone Company has been incorporated with a capital stock of $10,000. The company will install an exchange at Harmony Corners. The incorporators are J. H. Tiedjens, president; D. J. Armstrong, vice-president; Frank Fuhrman, secretary; E. F. Christine, treasurer; H. B. Reeves, manager, Oconto.

HOLMEN, WIS.—Articles of incorporation have been filed for the Holman Telephone Company with a capital stock of $25,000. The incorporators are B. Keppel, A. O. Casberg, Julius Berg, W. C. Sandiman, J. M. Holderson and C. B. Sletteland.

CLOVER, WIS.—The Clover Telephone Company has been incorporated by Peter Sorenson, Jr., Otto E. Kauppi and Herman Louma; capital stock, $3,000.

ROCK FALLS, WIS.—The Rock Falls and Meridian Telephone Exchange Company has been incorporated with a capital stock of $5,000 by L. E. Hagen, J. P. Forum and Gilbert Jerne.

CHEYENNE, WYO.—Articles of incorporation have been filed for the Lyman Telephone Company; capital stock, $10,000.

SUNDANCE, WYO.—The Inyan Kara Telephone Company has been incorporated with a capital stock of $5,000.

FINANCIAL ITEMS.

HARTFORD, CONN.—The East Haven and Electric Company recently increased its capital stock from $5,000 to $10,000.

GAINESVILLE, FLA.—One of the largest mortgages ever filed in the county has just been placed on record by the Southern Bell Telephone Company to the Bankers' Trust Company and John H. Parsons, as trustees, and involves a consideration of $50,000,000. It was issued for the purpose of securing that amount in sinking funds gold bonds, dated January 2, 1941, and the funds are contemplated for making improvements over the system of the Southern Bell Company.

CHICAGO, ILL.—An order authorizing the Illinois Tunnel Company to borrow $1,000,000, and issue promissory notes bearing 6 per cent interest for that amount, was recently signed by Judge C. C. Kohlsaat in the United States Court. Half of the amount, which will be used in improvements, will be issued at once. It is understood the other half will be used in completing the automatic telephone system.

GALESBURG, ILL.—The Mutual Telephone Company has filed a certificate increasing its capital stock from $15,000 to $40,000, and making the number of shares 400 instead of 300.

LOCKPORT, N. Y.—Papers filed in the county clerk's office show that the Federal Telephone and Telegraph Company has given a mortgage of $25,000,000 on all its property in ten counties of western New York to the Trust Company of America.

BARRE, VT.—A petition has been filed with the Public Service Commission by the Vermont Telephone and Telegraph Company asking permission to increase its capital stock from $125,000 to $135,000, and to issue $60,000 of its authorized stock to reduce floating indebtedness.

CHESTERFIELD, S. C.—The Chesterfield Telephone Company has been granted permission to increase its capital stock from $500 to $6,000.

LEESBURG, VA.—For the purpose of making improvements and extensions, the Leesburg Telephone Company has decided to increase its capital stock from $10,000 to $25,000.

SAWYER, WIS.—The Sawyer Western Telephone Company has increased its capital stock from $600 to $2,000.

RATES.

COVINGTON, GA.—The Southern Bell Telephone Company has notified its patrons that the rate for business telephones will be increased 50 cents, effective September 1.

NEW PLYMOUTH, IDAHO.—Great dissatisfaction is felt over the increase of rates which has gone into effect since the Rocky Mountain Bell Telephone Company took over the Independent Telephone system and it is thought the result will be the formation of an independent system.

MIDDLEVILLE, MICH.—On account of an increase from $12 to $15 on residence telephones and $15 to $18 on business telephones, patrons of the Citizens' Telephone Company in this place have circulated an agreement proposing to remove telephones if the rates are not reduced to what they were formerly.

VERMONTVILLE, MICH.—As the result of increased rates it has been voted to organize an independent telephone company in this place. The new company will need about $20,000, part of which has been subscribed.

ELGIN, OREG.—Following the increase of rates by the Home Telephone Company, of Legrande, practically every patron in this vicinity has ordered the telephones removed. The Farmers' Union at this place is considering the construction of a new line.

HAMMONDSPORT, N. Y.—The Hammondsport Telephone Company has been granted permission to amend its franchise and increase its rates to $9.00 for residence and $12.00 for business telephones.

BROOKLYN, N. Y.—Following the issuance of final orders by the Public Service Commission, Second District, which has jurisdiction over telephone matters, rates for telephone service between Manhattan and Brooklyn will be reduced to five cents after December 1.

DAYTON, WASH.—A committee was appointed some weeks ago by the commercial club to investigate the rates being charged by the Pacific Telephone and Telegraph Company. As a result of the report the secretary has been instructed to ask the company for a reduction to $2.50 for business houses and $1.25 for residences.

FRANCHISES ASKED AND GRANTED.

WEST PALM BEACH, FLA.—The West Palm Beach Telephone Company has been granted a franchise by the town council.

NAPA, CAL.—H. Voorman Du Bois has been granted a 20-year franchise to construct and operate a telephone line near Napa.

PLUMMER, IDAHO.—C. G. Mead of the Interstate Consolidated Telephone Company of Spokane, has been granted a franchise to install and operate a telephone system in this place and vicinity.

MACOMB, ILL.—The city council recently granted Edward S. Slusher of Blandinsville, a franchise to install a telephone system in this place.

MT. VERNON, IND.—The refusal of the city council, by unanimous vote, to reconsider its offer to the Cumberland Telephone and Telegraph Company of a franchise providing for residence telephones at $1.25 and party lines and business lines at $2.50, leaves the company operating here without a franchise. The council says the company will accept the terms or leave the field.

ATHOL, KY.—R. R. Lord, representing the East Tennessee Telephone Company, has been granted permission by the Breathitt County Circuit Court, to construct a long distance telephone line from Athol through Breathitt county.

HANNIBAL, MO.—The Bluff City Telephone Company is seeking an extension of its franchise in order that it may make improvements and extensions.

CONSTRUCTION NOTES.

TUCSON, ARIZ.—The Arizona Telephone Company, formerly the Consolidated Company, will rebuild its line from Solomonville to Pima and will install a new switchboard.

SAN FRANCISCO, CAL.—Plans have been completed for the construction of a new building by the Pacific Telephone and Telegraph Company in the Sunset district, which will cost in the neighborhood of $30,000 when completed.

PINEVILLE, KY.—The Sandy Valley Telephone Company will construct lines, install exchanges, etc. The officers of the company are: President, and general manager, John A. Bentley; vice-president, J. M. Robinson; secretary, W. H. Flanery; treasurer, S. K. Smallwood.

Glendive, Mont.—The Montana Eastern Telephone Company will construct a line from Terry, Mont., to Marmath, N. D., where connection will be made with the Tri-State Telephone Company of Minneapolis.

Joseph, Oreg.—J. F. McClain, superintendent of the Wallowa forest reserve, has been instructed to construct a telephone line from this place to the Ranger's camp.

MISCELLANEOUS.

Cobleskill, N. Y.—The Cobleskill Telephone Company has been purchased by the New York Telephone Company.

Minot, N. D.—The Minot Light and Telephone Company has been taken over by the H. M. Byllesby Company, one of the largest electrical, telephone, gas and water power corporations in the United States. They are represented at Minot by A. E. Stevens, who will have the management of the electric and telephone plant. R. G. Hunt and W. H. Hodge.

Ashtabula, Ohio.—The Northeastern Ohio Telephone Association which represents 4,000 telephones, 1,000 miles of poles and 2,000 miles of wire, recently held its annual meeting in this city. The following officers were elected for the coming year: President, C. E. Noble, Windsor; vice-president, A. D. Benson, Pierpont; secretary, W. S. Holcomb, Plymouth; treasurer, W. E. Stults, Orwell; executive committee, C. E. Noble, Harry McConnell, Dorset; M. Chapin, Lenox; J. S. Seeley, Mesopotamia; G. DeForest Gibbs, Andover.

Tulsa, Okla.—The Pioneer Telephone & Telegraph Company has just completed a new five-story building and is installing a new switchboard and power plant which, when complete, will be the second largest in the state.

Berclair, Texas.—The local telephone company has been purchased by Oscar Kemp.

Nixon, Texas.—The Nixon telephone system operated by O. W. Askey has been purchased by a company of business men and farmers of Nixon and Leesville who will operate the same.

Ennis, Texas.—At the annual meeting of the Ellis County Telephone Company the following officers were elected: President, F. H. Benner, Waxahachie; vice-president, W. L. Harper, of Ennis; treasurer, J. Baldridge, of Ennis; secretary and general manager, T. A. Gould, of Ennis.

Loraine, Texas.—The telephone exchange of this place, formerly owned and operated by J. T. Ledbetter, has been purchased by J. N. McCaghren, of Odessa.

Fond du Lac, Wis.—The Fond du Lac Rural Telephone Company and the Empire Telephone Company have been consolidated under the name of the former. The capital stock of the new concern is $20,000 and the new officers are as follows: President, William C. Ray; secretary and treasurer, William T. Reill; vice-president, John M. Dowd. The new company contemplates extensions and improvements.

Milwaukee, Wis.—During the year the Wisconsin Telephone Company contemplates the expenditure of $850,000 in improvements in the state which will include the addition of 6,000 miles of toll wire, new exchanges at Appleton, Beloit and the new northwest exchange at Milwaukee, and other improvements. Announcement was made at the annual meeting of the six district managers, six district foremen and officials of the company and President Alonzo Burt.

Sidney, Ohio.—The Farmers' Telephone Company has elected the following officers: President, Orrin C. Staley; vice-president, J. H. Millhouse; secretary, Charles F. Snyder; treasurer, T. M. Beamer.

Geneva, Ohio.—The Madison Telephone Company has been purchased by the People's Telephone Company.

Murdo, S. D.—The Interior Telephone Company plans to build telephone lines extending out from this place.

Snyder, Tex.—The Scurry County Independent Telephone Company has been purchased by the Southwestern Telephone Company for a consideration of $20,000. The company has exchanges in Scurry, Kent, Graza and Borden counties. George T. Curtis is manager of the company.

Lometa, Tex.—The Dent Telephone Company has been purchased by the Western Telephone Company of Brownwood, who will make extensive improvements and will install an exchange here.

Paris, Tex.—The Citizens' Telephone Company has elected the following officers: President and general manager, Jos. Timmons; secretary, J. E. Seymour; treasurer, F. D. Bain. Some extensions and improvements are contemplated by the company, including the erection of a building.

El Paso, Tex.—The Tri-State Telephone Company of Denver has been granted permission to do business in Texas with headquarters at El Paso.

Salt Lake City, Utah.—The Utah Independent Telephone Company was recently purchased at public auction by the Rocky Mountain Bell Telephone Company for the sum of $1,200,000.

Monroe, Wis.—Arrangements have been completed for the consolidation of the Monroe and United Telephone Companies of this place and as soon as completed the Monroe company will pass out of existence.

Cullman, Ala.—V. A. Fuller and L. K. Manning, two enterprising farmers of the county, have purchased all lines formerly owned by the Morgan County Telephone Company leading out from this place. The new owners will install an exchange at Good Hope. Cullman has the distinction of having a greater per cent of patrons of the telephone of any town of its size in the state.

Eureka Springs, Ark.—The J. W. Hill Telephone Company of this city has been purchased by the Southern Telephone Company for $25,000.

Waldron, Ark.—H. B. Lowe, general manager and owner of the Waldron telephone system, has sold his plant here to William Firsby, also the Greenwood exchange, which was owned by Mr. Lowe, the consideration for both properties being $22,000.

Atkins, Ark.—The Atkins telephone system has been purchased by L. E. Carmichael of Heber Springs, who will improve the same, making metallic circuits.

Willows, Cal.—The Pacific States Telephone and Telegraph Company contemplates extensive improvements in its plant at this place, involving an expenditure of $15,000.

Covine, Cal.—An agreement has been entered into between the Covina Home Telephone Company and the Pacific Telephone and Telegraph Company, whereby a call placed with the Home company, will reach a subscriber of either company anywhere in the state.

Tucson, Ariz.—In accordance with an amendment to the articles of incorporation, the name of the Consolidated Telephone, Telegraph and Electric Company has been changed to the Arizona Telephone and Telegraph Company. C. W. Hinchcliffe is general manager of the company. J. C. Clemens is manager of the Tucson exchange and in direct charge of all construction, repairs and operations of the plant.

Rochelle, Ill.—The Oregon Mutual Telephone Company and the Ogle County Telephone Company have been consolidated and have formed a new company which will be known as the Rock River Telephone Company. The new company has elected the following officers: President, Alex. Anderson, Polo; vice-president, John Harris, Oregon; secretary and treasurer, A. B. Sheadle, Rochelle; directors, J. W. Hoops, Chana; G. W. Hamlin, F. W. Craft, W. P. Landon, and A. B. Sheadle, Rochelle; A. Shelley and John Harris, Oregon; C. A. Beebe, Forreston.

Rock Island, Ill.—A petition has been placed on file with the city clerk asking that the ordinance recently passed by the city commission giving the Union Electric Telephone Company the right to sell the Central Union be put to a vote of the citizens. The petition was circulated by the promoters of the Home Telephone Company of Rock Island who, it is claimed, will endeavor to gain a franchise in the city by invoking the initiative clause of the commission law.

Paxton, Ill.—At the annual meeting of the Central Telegraph and Telephone Company the following officers were elected: President, Chas. Bogardus; vice-president, Frank Lindley; secretary and treasurer, H. B. Henderson; manager, H. A. Ball. The report showed the company to be in good condition financially and otherwise, and that much work is steadily being done in repairing the lines and in some cases in rebuilding.

Newcastle, Ind.—The Central Union Telephone Company has purchased all property and franchises of the Newcastle Telephone Company, including rural lines. Rates will be increased about 30 per cent. The present rates are $1.00 a month for residence and $2.00 for business telephones.

Red Oak, Ia.—The mutual telephone companies of Southwestern Iowa, recently met in this place and formed the Western Iowa Association. Levi Baker of Shenandoah was chosen president and George Atkinson, Creston, secretary and treasurer.

Webster City, Ia.—E. H. Martin, president of the Martin Telephone Company of this city and widely known to the telephone field, has purchased the factory, material on hand, patents, etc., of the Williams Time Switch Company of New York.

Onsted, Mich.—At the annual meeting of the Onsted Telephone Company the following officers were re-elected: President, L. S. Mann; vice-president, S. R. Redfield; secretary, J. B. Daniels; treasurer, G. W. Greenleaf; board of managers, Jona Hand, Barnard Hicks, George Hicks.